KERN

EN

Laboratory — Industry — Food Industry

DAKKS CALIBRATION SERVICE, VERIFICATION SERVICE

PROFESSIONAL MEASURING

180 YEARS since 1844 KERN & SOHN

24

KERN Pictograms

Internal adjusting
Quick setting up of the balance's accuracy with internal adjusting weight (motordriven)

Adjusting program CAL
For quick setting up of the balance's accuracy. External adjusting weight required

EasyTouch
Suitable for the connection, data transmission and control through PC or tablet

Memory
Balance memory capacity, e.g. for article data, weighing data, tare weights, PLU etc.

Alibi memory
Secure, electronic archiving of weighing results, complying with the 2014/31/EU standard.

KERN Universal Port (KUP)
allows the connection of external KUP interface adapters, e.g. RS-232, RS-485, SB, Bluetooth, WIFI, Analogue, Ethernet etc. for the exchange of data and control commands, without installation effort

RS-232 Data interface
To connect the balance to a printer, PC or network

RS-485 Data interface
To connect the balance to a printer, PC or other peripherals. Suitable for data transfer over large distances. Network in bus topology is possible

USB Data interface
To connect the balance to a printer, PC or other peripherals

Bluetooth* Data interface
To transfer data from the balance to a printer, PC or other peripherals

WIFI Data interface
To transfer data from the balance to a printer, PC or other peripherals

Control outputs
(optocoupler, digital I/O)
To connect relays, signal lamps, valves, etc.

Analogue interface
to connect a suitable peripheral device for analogue processing of the measurements

Interface for second balance
For direct connection of a second balance

Network interface
For connecting the scale to an Ethernet network

KERN Communication Protocol (KCP)
It is a standardized interface command set for KERN balances and other instruments, which allows retrieving and controlling all relevant parameters and functions of the device. KERN devices featuring KCP are thus easily integrated with computers, industrial controllers and other digital systems

GLP/ISO log intern
The balance displays weight, date and time, independent of a printer connection

GLP/ISO log Printer
With weight, date and time. Only with KERN printers.

Piece counting
Reference quantities selectable.
Display can be switched from piece to weight

Recipe level A
The weights of the recipe ingredients can be added together and the total weight of the recipe can be printed out

Recipe level B
Internal memory for complete recipes with name and target value of the recipe ingredients. User guidance through display

Totalising level A
The weights of similar items can be added together and the total can be printed out

Percentage determination
Determining the deviation in % from the target value (100 %)

Weighing units
Can be switched to e.g. nonmetric units. See balance model. Please refer to KERN's website for more details

Weighing with tolerance range (Checkweighing)
Upper and lower limiting can be programmed individually, e.g. for sorting and dosing. The process is supported by an audible or visual signal, see the relevant model

Hold function
(Animal weighing program)
When the weighing conditions are unstable, a stable weight is calculated as an average value

Protection against dust and water splashes IPxx
The type of protection is shown in the pictogram

Suspended weighing
Load support with hook on the underside of the balance

Battery operation
Ready for battery operation. The battery type is specified for each device

Rechargeable battery pack
Rechargeable set

Universal plug-in power supply
with universal input and optional input socket adapters for
A) EU, CH, GB
B) EU, CH, GB, US
C) EU, CH, GB, US, AUS

Plug-in power supply
230V/50Hz in standard version for EU, CH.
On request GB, USA or AUS version available

Integrated power supply unit
Integrated in balance.
230V/50Hz standard EU.
More standards e.g.
GB, USA or AUS on request

Weighing principle Strain gauges
Electrical resistor on an elastic deforming body

Weighing principle Tuning fork
A resonating body is electromagnetically excited, causing it to oscillate

Weighing principle Electromagnetic force compensation
Coil inside a permanent magnet. For the most accurate weighings

Weighing principle Single cell technology
Advanced version of the force compensation principle with the highest level of precision

Conformity Assessment
The time required for conformity assessment is specified in the pictogram

DAkkS calibration possible (DKD)
The time required for DAkkS calibration is shown in days in the pictogram

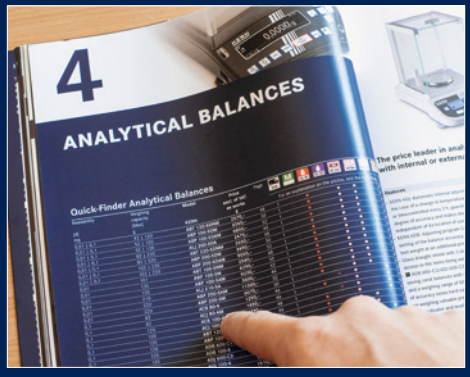
Factory calibration (ISO)
The time required for Factory calibration is shown in days in the pictogram

Package shipment
The time required for internal shipping preparations is shown in days in the pictogram

Pallet shipment
The time required for internal shipping preparations is shown in days in the pictogram

*The *Bluetooth*® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by KERN & SOHN GmbH is under license. Other trademarks and trade names are those of their respective owners.

KERN Models A-Z



KERN Quick-Finder
How I quickly find the product I am looking for

Ahead of each product group allows you to base the search for a certain target group on weighing data you need such as readout, weighing capacity and main features for each model.

And it's as simple as that – find the product you want in 2 steps:
1. Go to the product group index on page 3
2. Pick the appropriate product group and find the product you want using the Quick-Finder

Balance & weight in the quality management system

Do you already use all the modules of the KERN precision package for maximum accuracy and reliability of your balance?

KERN precision package

As per ISO 9001, TS 16949, VDA 6.x, FDA, GLP, GMP, ...

Balance	+	DAkkS calibration certificate for the balance	+	Adjustment/Validation with KERN test weights	+	DAkkS-calibration certificate for the test weight	=	Maximum reliability for your measurements
	+						=	*Balance not adjusted, traceable*
	+		+				=	*Balance adjusted, weight not traceable*
			+		+		=	*Balance adjusted, not traceable*
	+		+		+		=	*Balance adjusted, completely traceable*

Information & ordering: kern-sohn.com/qmb

The KERN calibration laboratory (D-K-19408-01-00)

KERN has a highly-automated DAkkS laboratory with accreditation to DIN EN ISO/IEC 17025 in the field of balances, test weights and force measurement. By using the most modern calibration technology with high-end calibration robots in fully air-conditioned laboratories, the measurement uncertainty and process times are reduced to a minimum, and also the quality of the calibration is increased.

As an accredited and certified calibration service provider with decades of experience, KERN offers you an extensive range of services, which will leave no demand unfulfilled. The accreditation applies to the extent specified in the appendix to the certificate D-K-19408-01-00.

We offer the following services:

Balances

- DAkkS calibration up to 50 t
- Minimum sample weight (in use)
- Usage accuracy
- Adjustment at the location of installation
- Certificate of conformity
- Equipment qualification:
  > Design qualification (DQ)
  > Installation qualification (IQ)
  > Function qualification (OQ)
  > Performance qualification (PQ)
  > Maintenance qualification (MQ)
- Conformity assessment/Verification

Weights

- DAkkS calibration up to 2.5 t (OIML classes E1 – M3)
- Volume determination for OIML class E1
- Measuring of sensitivity (magnetic characteristics)
- Verification

Force measuring devices and force transducers

- DAkkS calibration up to 5 kN

Temperature and humidity sensors

- DAkkS calibration up to 50 °C resp. 75 %

Factory calibration for

- Force measuring devices and force transducers ≤ 250 kN
- Hardness
- Layer thickness
- Material thickness
- Temperature of moisture analysers

Our commitment to satisfy our customers never stops. Perhaps this is one of the reasons why our roots can perhaps be traced so far back in history.
Discover the KERN route to success: fast – competent – reliable – versatile!

The order process

1. You will receive a **reminder** that your test equipment is due or you will generate online a quotation for new or existing test equipment
2. Submission or collection of your test equipment
3. Initial inspection of your goods, to check that they are suitable for calibration, and are complete, etc.
4. You will get a detailed **order confirmation**
5. Our experts will carry out **initial calibration**
6. Checked for conformity with required tolerances and if required, any **necessary actions** which arise from this are carried out
7. Before these actions are carried out, we will contact you (in so far as no **individual processing** has been agreed with you beforehand)
8. After your **approval** the necessary actions will be implemented and the calibration will be completed
9. After that your **test equipment will be returned** to you without delay, together with the appropriate calibration certificates
10. We will **monitor your recalibration periods** and will send you a reminder about your next calibration, free of charge

Our service

▸ **Reminder service**
The continuous cyclic recalibration of your checking equipment is an integral part of the reliable management of test equipment. You can rely on us to support you, and we will remind you in time, free of charge, when the next recalibration is due. In addition, you have the option of managing your test equipment online by yourself (cf. 1, 10).

▸ **Quote generator**
You will be impressed by our price-to-performance ratio. Request a non-binding quotation or create it yourself to suit your specifications at www.kern-lab.com (cf. 1)

▸ **Collection service**
We will be pleased to arrange a pick up by our forwarding agent the goods from your premises. You only need to tell us the weight and dimensions of your package and leave the rest to us (cf. 2)

▸ **Repair and reconditioning of balances and weights**
KERN will get your weights back up to standard, regardless of the manufacturer. Whether it is adjustment, marking, sand blasting or lacquering - the aim here is compliance and long-term stability. Any repairs of balances and instruments which may be necessary can be carried out quickly and easily (cf. 5, 6)

▸ **Individual processing**
In order to avoid delays with future orders, we would be pleased to incorporate your individual requirements for future processing of such calibration results. Even for smaller issues such as the printing of calibration certificates (stapling, punching, double-sided) we can work to your requirements (cf. 8).

▸ **Express service and dispatch**
If you need a particularly fast service, you can use your DAkkS express service. You will receive your test equipment after only 2 days (cf. 9).

www.kern-lab.com – the central portal for everything you need to know about the extensive KERN calibration services

On our website you will always find the latest news and useful information about testing and measuring devices, calibration, legal metrology and expansions to our range of services. You will also find numerous online services on the website.

Database supported management of test equipment
Information on your test equipment which has been calibrated by us is stored in our database. In this way it is possible to make trend calculations. You will therefore get an overview about the long-term stability and trend behaviour of your test equipment as well as the necessary recalibration period can easily be determined and specified.

Paperless documentation
So there is no administrative effort, we can handle all calibration documentation in a paperless process. From quotation, through to order confirmation, delivery note and invoice right up to calibration certificate, you will receive all documents by e-mail or you can retrieve them online. Would you prefer to receive your certificate or your invoice in paper form, for example? Of course this is not a problem either.
We will send you everything you require by post.

Calibration certificate download
By using our download service you can easily download your calibration certificates as soon as the calibration work is complete and you will have access to them at any time in the future. Simply create your user account on www.kern-lab.com and you will never have to look for your certificates again.

DAkkS Calibration of balances

Any balance will only give correct results if it is checked regularly, i.e. calibrated correctly and adjusted when required. A balance is only a reliable measuring and checking tool if it is calibrated and this calibration is documented. The issued DAkkS calibration certificates are proof of the metrological traceability to national and international standards, as required by the DIN EN ISO 9000 and DIN EN ISO/IEC 17025 standards, amongst others.
KERN recommends a recalibration period of one year. The standard does not give a defined recalibration period. KERN recommends that, with intensive (daily) use, you to recalibrate your balance every 6 months and at normal (weekly) use, every 12 months.

The advantages of using on-site calibration:

+ **Calibration on-site** at your premises in the field of use
+ **Minimisation of measurement uncertainty** and guarantee of process accuracy strictly according to guideline EURAMET cg-18
+ **No risk of damage** during transportation
+ **Low downtime**
+ **Direct and personal contact** with the service technician
+ **Cross-brand servicing,** basic inspection and adjustment by a specialist
+ You tell us **when you would like us to come**
+ **Device training** for qualified users

The advantages of using in-house calibration:

+ **Short calibration time:** Test time in the laboratory is only four working days
+ **Competence:** Calibration laboratory, which complies with the highest standards in the area of metrology
+ **Independent management** of the recalibration calendar for your individual measuring instrument is possible
+ **Cross-brand service:** Measuring devices from any manufacturer can be calibrated independently
+ **Repair:** Any necessary repairs can be carried out immediately, if you wish

a) KERN on-site calibration (we visit you)

In Germany, KERN has a close-knit network of KERN DAkkS calibration laboratory employees, who can carry out on-site calibration of balances up to 50 tonnes.

This on-site testing service is metrologically recommended, as your balance is in its field of use and can be calibrated without any possible transportation problems.

Lower downtime and personal contact with our expert are the major benefits of this service.

Preparatory maintenance work by agreement. Prices for on-site calibration on request.

You tell us when you would like us to come, giving us details of the balances to be tested. Our on-site DAkkS calibration team will then get in touch with you immediately and will discuss the process with you at your premises – it's straight forward and professional.

This KERN calibration service is also independent of the brand.

Please feel free to contact us at Phone +49 7433 9933-400 or
E-Mail: testservices-onsite@kern-sohn.com

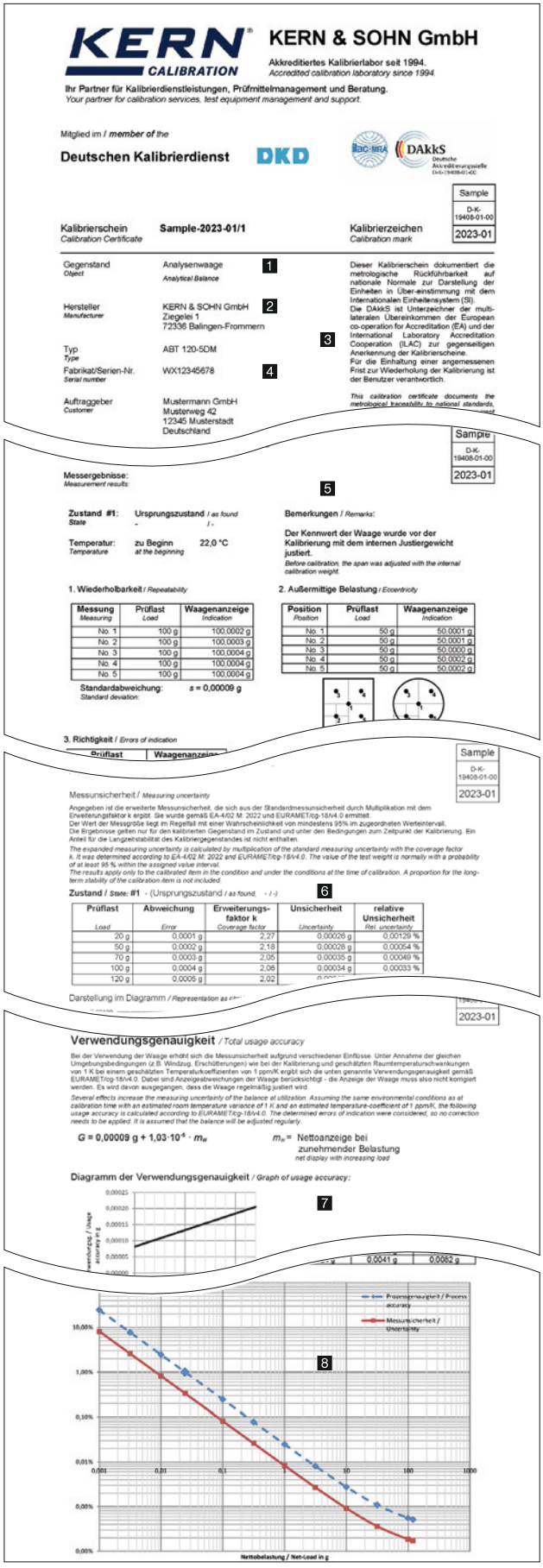
b) Calibration at the KERN factory (you send your balance to us)

Recommended for new devices and for balances which can be affordably transported, as then there is no need for us to travel to carry out the calibration on-site. Repairs can be carried out at the same time, quickly and in full.

The process would be as follows:

Day 1:	Send your balance to the KERN calibration laboratory in Balingen.
Day 2 to 3:	Evaluation and calibration of your balance by our specialists.
Day 4:	After positive validation, your balance is returned.

Please feel free to contact us at Phone +49 7433 9933-400 or
E-Mail: recalibration-balances@kern-sohn.com



DAkkS calibration certificate for balances (extract)

To get reliable weighing results you need to have calibrated balances. KERN offers you an extensive calibration service for your balances – You have the choice:

Recalibration

- The recalibration schedule depends on the frequency of use, the conditions of use and the safety requirements.
- We would recommend that you recalibrate your balances every 6 months if they are used intensively, and every 12 months with normal use.
- The KERN calibration service is independent of the brand.

Initial calibration and recalibration of balance at the KERN factory	KERN	Price excl. of VAT ex works €
Weighing capacity		
Analytical balances		
[Max] ≤ 5 kg	963-101	**191,-**
[Max] > 5 kg	963-102	**240,-**
Precision balances/Industrial scales		
[Max] ≤ 5 kg	963-127	**98,-**
[Max] > 5 kg – 50 kg	963-128	**118,-**
[Max] > 50 kg – 350 kg	963-129	**146,-**
[Max] > 350 kg – 1500 kg	963-130	**205,-**
[Max] > 1500 kg – 2900 kg [1]	963-131	**275,-**
[Max] > 2900 kg – 6000 kg [1]	963-132	**550,-**
[Max] > 6000 kg – 12000 kg [1]	963-133	**620,-**
Hanging scales/Crane scales		
[Max] ≤ 5 kg	963-127H	**98,-**
[Max] > 5 kg – 50 kg	963-128H	**118,-**
[Max] > 50 kg – 350 kg	963-129H	**138,-**
[Max] > 350 kg – 1500 kg	963-130H	**245,-**
[Max] > 1500 kg – 2900 kg	963-131H	**375,-**
[Max] > 2900 kg – 6000 kg	963-132H	**620,-**
[Max] > 6000 kg – 12000 kg [3]	963-133H	**870,-**
Preparation for recalibration (cleaning, adjustment, function test)	969-003R	**24,-**
Additional services		
Minimum weight of sample (for details see page 227)	969-103	**10,-**
Additional measurement points (as part of the) weighing test	963-140	**5,50/** measurement point
Additional measurement points (as part of the) repeatability testing	963-140	**5,50/** each further measurement point
DAkkS Express service with delivery time 48 hours (only on initial purchase, details see p. 222)	962-116	**52,-/ scale**
Express shipping: Express supplement for guaranteed delivery on the next working day (if ready for shipment before 12:00 noon)	in GER only (other countries on request)	**40,-/ parcel**

[1] Floor scales & axle load scales only (Price per weighing panel). Please ask for further details.
[2] On request
[3] Processing time 4 working days
[4] Processing time 15 working days

1 Official document
2 Item to be calibrated
3 Traceability, see the *Glossary*
4 Identification/Applicant
5 Metrological component
6 Uncertainty of measurement, see the *Glossary*
7 Application accuracy, see the *Glossary*
8 Minimum weight of sample (additional price)

Minimum weight of sample (in use)

What is the lightest item you can weigh on your balance, while still achieving accurate and reliable weighing results? What exactly is the limit?

The KERN minimum sample weight protocol accounts for the established minimum sample weight of your balance and its location of installation and use with the relative measuring uncertainty. With various safety coefficients and required weighing accuracy (process accuracy), depending on standard or quality-related requirements on the balance being used.

The higher the selected safety coefficient, the higher the safety when using the balance in a particular process.

Typical perturbations when using the balance e.g. small fluctuations in temperature are taken into account. In easily predictable conditions in a professional environment of use, KERN recommends a safety coefficient of 3. For critical processes, a correspondingly higher factor should be selected. The minimum sample weight protocol contains a diagram as well as a table, from which you can ascertain the minimum sample weight for your balance, depending on the process.

Adjustment at the location of installation

Why?
Adjustment at the location of installation is necessary, as the measuring results of balances depend on the local gravitational force (gravitational acceleration) and therefore depend on the location of use. KERN can carry this out just before shipping at the factor, individually to suit the location of installation.

What are the advantages of carrying out adjustment at the location of installation?

- The balance gives reliable measurement results at the location of installation.
- No time-consuming on-site adjustment necessary.
- You do not need a Service Engineer or any additional weights.
- The balance is ready for immediate use.

Pricing table for adjustment at the location of installation

Weighing capacity	KERN	Price excl. of VAT ex works €
[Max] ≤ 5 kg	961-247	**41,-**
[Max] > 5 – 50 kg	961-248	**50,-**
[Max] > 50 – 350 kg	961-249	**59,-**
[Max] > 350 – 1500 kg	961-250	**94,-**
[Max] > 1500 – 2900 kg	961-251	**125,-**
[Max] > 2900 – 6000 kg	961-252	**250,-**
[Max] > 6000 – 12000 kg	961-253	**285,-**

For adjustment to the location of installation you need the value for gravitational acceleration at the location of installation, which KERN can calculate using the point of use. The procedure is suitable for balances with a resolution of <60,000 d. For higher resolutions we recommend a balance with an internal adjusting weight or adjustment with a calibrated adjusting weight at the location of installation.

Certificate of conformity

With a certificate of conformity you get a statement about whether the balance meets your defined requirements. In conjunction with a DAkkS calibration certificate it serves as documented proof that the balance fulfils the required process demands. When doing this the process owner for the balance can select from different temperature specifications – depending on its individual requirements:

Conformity evaluation on the basis of the:	KERN		Price excl. of VAT ex works €
Usage accuracy*	relative absolute	969-511 969-512	on request
Calibration results*	relative absolute	969-513 969-514	on request
Measurements as manufacturer or customer specification	Foreign device Customer specifications KERN devices	969-515 969-516 969-517	on request

relative = % / absolute = g *as attachment to the DAkkS calibration certificate (Details see www.kern-lab.com)

Example for absolute customer tolerance (absolute) (Item no. 969-511):

No.	Tare	Load	Display	Deviation	Uncertainty	Customer tolerance	Conformity[1)]
1	0 g	500 g	500,00 g	0,00 g	± 0,013 g	± 0,05 g	☑
2	0 g	1000 g	1000,00 g	0,00 g	± 0,015 g	± 0,05 g	☑
3	0 g	1500 g	1500,01 g	0,01 g	± 0,017 g	± 0,05 g	☑
4	0 g	2000 g	2000,01 g	0,01 g	± 0,020 g	± 0,10 g	☑
5	0 g	3000 g	3000,02 g	0,02 g	± 0,022 g	± 0,10 g	☑

1) Evaluation criteria: |[Deviation]| + [extended measuring uncertainty] ≤ [tolerance]

Documented quality of your balances in the log book

Consistently high product quality requires the use of measuring and test equipment that provides comprehensible, consistent and reproducible results. Hence, quality management systems require that measuring and test equipment produces a detailed traceable description and documentation of calibration results and conformity statements. According to the guiding principle of GMP/GLP: „Work not documented is work not done."

Equipment qualification is documentary evidence that a equipment is suitable for the intended purpose and is working faultlessly. A balance log book as well as our EQS (Equipment Qualification Software) is used to record all activities and results required for the qualification and monitoring of balances during routine operation. This includes the installation and commissioning of the balances, routine tests, maintenance as well as the recording of special events (failures, repairs, change of location).

The structure of the balance log book is based on the qualification process of the balance. The requirements for the qualification system such as DIN EN ISO 9001, DIN EN ISO/IEC 17025, GLP/GMP, VDA must be taken into account. The log book supports the user in his/her daily work with the balance and is meant to serve as necessary evidence during inspections and audits. The responsibility for maintaining the log book and its appropriate use is to be borne by the user.

Our proposal: Count on our support!

KERN offers this qualification concept throughout. Our validation services are carried out on the spot by technicians of our calibration laboratory and comprise among other things: installation, measurement test inclusive DAkks calibration certificate as well as records in your qualification log book of the EQS software (Equipment Qualification Software).

We give you advice already when selecting a new device, for example KERN ADB/ADJ, ALS/ALJ, ABS/ABJ, ACJ, ABT, ABP, PLS/PLJ, PNS/PNJ, EG-N, PBS/PBJ, PES/PEJ, about the options of device qualification on the location of use.

We offer individual calibration and maintenance agreements for the periodically required requalification.

Further information can be found at www.kern-lab.com

Important elements of equipment qualification:

Design qualification (DQ)

With the design qualification, all requirements on which you as a user depend are defined. The purchase decision is made on the basis of the design specifications and the available devices. Careful selection in the DQ can prevent subsequent deficiencies.

Installation qualification (IQ)

All steps to be taken for the installation and commissioning of the equipment are described in detail in the installation qualification. These include among others:

- checking for completeness of delivery and assurance that the delivered equipment meets the required specifications
- a description of the ambient conditions at the place of installation
- proper installation and assurance that the equipment is ready for operation after installation
- documentation of equipment configuration and equipment settings
- Recording and installation of connected peripherals units

Function qualification (OQ)

The operational qualification describes the metrological test performed for the balance at the place of installation. In the course of this all parameters that define the efficiency of a measurement will be checked. Functional qualification is carried out with the help of a standard operating procedure (SOP) and recorded in a calibration certificate. The OQ must be carried out by trained staff with the help of qualified aids (such as certified weights that are traceable to an approved standard). Briefing / training of users must be assured and recorded in the OQ.

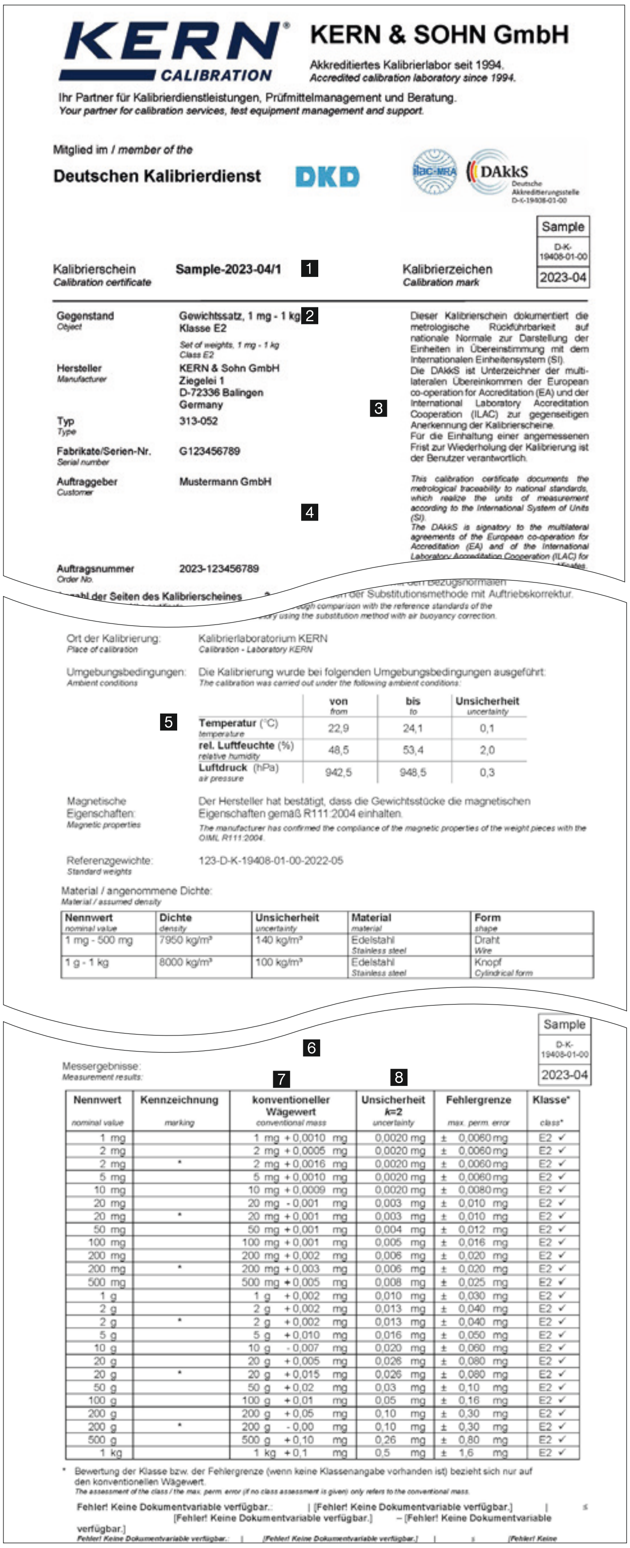
Performance qualification (PQ)

The PQ represents documented evidence that the balance or weighing system functions in the selected application as intended. This will be assured by a qualification test of the equipment under real conditions with respect to its surroundings and the problem definition (such as traceable data transmission).

Maintenance qualification (MQ)

The periodical maintenance, cleaning work and complete metrological test of the balance/weighing system is documented in the MQ by a trained authorised engineer. Maintenance is carried out with the help of a maintenance schedule. The maintenance times are determined by you. We are happy to support you with a maintenance contract for the entire organisation of your measuring system.

If you are interested in a training for equipment qualification, please feel free to contact us at **+49 7433 9933-400** or **testservices-onsite@kern-sohn.com**



KERN & SOHN GmbH

Akkreditiertes Kalibrierlabor seit 1994.
Accredited calibration laboratory since 1994.

Ihr Partner für Kalibrierdienstleistungen, Prüfmittelmanagement und Beratung.
Your partner for calibration services, test equipment management and support.

Mitglied im / *member of the*
Deutschen Kalibrierdienst

Sample | D-K-19408-01-00 | 2023-04

Kalibrierschein / *Calibration certificate*: **Sample-2023-04/1** 1

Kalibrierzeichen / *Calibration mark*

Gegenstand / *Object*	Gewichtssatz, 1 mg - 1 kg 2 Klasse E2 *Set of weights, 1 mg - 1 kg* *Class E2*
Hersteller / *Manufacturer*	KERN & Sohn GmbH Ziegelei 1 D-72336 Balingen Germany
Typ / *Type*	313-052
Fabrikate/Serien-Nr. / *Serial number*	G123456789
Auftraggeber / *Customer*	Mustermann GmbH
Auftragsnummer / *Order No.*	2023-123456789

3 Dieser Kalibrierschein dokumentiert die metrologische Rückführbarkeit auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the metrological traceability to national standards, which realize the units of measurement according to the International System of Units (SI).
The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for …

4

…ahl der Seiten des Kalibrierscheines …

… der Substitutionsmethode mit Auftriebskorrektur.
… comparison with the reference standards of the … using the substitution method with air buoyancy correction.

Ort der Kalibrierung: / *Place of calibration* — Kalibrierlaboratorium KERN / *Calibration - Laboratory KERN*

Umgebungsbedingungen: / *Ambient conditions* — Die Kalibrierung wurde bei folgenden Umgebungsbedingungen ausgeführt: / *The calibration was carried out under the following ambient conditions:*

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	von *from*	bis *to*	Unsicherheit *uncertainty*
Temperatur (°C) *temperature*	22,9	24,1	0,1
rel. Luftfeuchte (%) *relative humidity*	48,5	53,4	2,0
Luftdruck (hPa) *air pressure*	942,5	948,5	0,3

Magnetische Eigenschaften: / *Magnetic properties* — Der Hersteller hat bestätigt, dass die Gewichtsstücke die magnetischen Eigenschaften gemäß R111:2004 einhalten.
The manufacturer has confirmed the compliance of the magnetic properties of the weight pieces with the OIML R111:2004.

Referenzgewichte: / *Standard weights* — 123-D-K-19408-01-00-2022-05

Material / angenommene Dichte:
Material / assumed density

Nennwert *nominal value*	Dichte *density*	Unsicherheit *uncertainty*	Material *material*	Form *shape*
1 mg - 500 mg	7950 kg/m³	140 kg/m³	Edelstahl *Stainless steel*	Draht *Wire*
1 g - 1 kg	8000 kg/m³	100 kg/m³	Edelstahl *Stainless steel*	Knopf *Cylindrical form*

6

Sample | D-K-19408-01-00 | 2023-04

Messergebnisse:
Measurement results:

7 8

Nennwert *nominal value*	Kennzeichnung *marking*	konventioneller Wägewert *conventional mass*	Unsicherheit k=2 *uncertainty*	Fehlergrenze *max. perm. error*	Klasse* *class**
1 mg		1 mg + 0,0010 mg	0,0020 mg	± 0,0060 mg	E2 ✓
2 mg		2 mg + 0,0005 mg	0,0020 mg	± 0,0060 mg	E2 ✓
2 mg	•	2 mg + 0,0016 mg	0,0020 mg	± 0,0060 mg	E2 ✓
5 mg		5 mg + 0,0010 mg	0,0020 mg	± 0,0060 mg	E2 ✓
10 mg		10 mg + 0,0009 mg	0,0020 mg	± 0,0080 mg	E2 ✓
20 mg		20 mg - 0,001 mg	0,003 mg	± 0,010 mg	E2 ✓
20 mg	•	20 mg + 0,001 mg	0,003 mg	± 0,010 mg	E2 ✓
50 mg		50 mg + 0,001 mg	0,004 mg	± 0,012 mg	E2 ✓
100 mg		100 mg + 0,001 mg	0,005 mg	± 0,016 mg	E2 ✓
200 mg		200 mg + 0,002 mg	0,006 mg	± 0,020 mg	E2 ✓
200 mg	•	200 mg + 0,003 mg	0,006 mg	± 0,020 mg	E2 ✓
500 mg		500 mg + 0,005 mg	0,008 mg	± 0,025 mg	E2 ✓
1 g		1 g + 0,002 mg	0,010 mg	± 0,030 mg	E2 ✓
2 g		2 g + 0,002 mg	0,013 mg	± 0,040 mg	E2 ✓
2 g	•	2 g + 0,002 mg	0,013 mg	± 0,040 mg	E2 ✓
5 g		5 g + 0,010 mg	0,016 mg	± 0,050 mg	E2 ✓
10 g		10 g - 0,007 mg	0,020 mg	± 0,060 mg	E2 ✓
20 g		20 g + 0,005 mg	0,026 mg	± 0,080 mg	E2 ✓
20 g	•	20 g + 0,015 mg	0,026 mg	± 0,080 mg	E2 ✓
50 g		50 g + 0,02 mg	0,03 mg	± 0,10 mg	E2 ✓
100 g		100 g + 0,01 mg	0,05 mg	± 0,16 mg	E2 ✓
200 g		200 g + 0,05 mg	0,10 mg	± 0,30 mg	E2 ✓
200 g	•	200 g - 0,00 mg	0,10 mg	± 0,30 mg	E2 ✓
500 g		500 g + 0,10 mg	0,26 mg	± 0,80 mg	E2 ✓
1 kg		1 kg + 0,1 mg	0,5 mg	± 1,6 mg	E2 ✓

* Bewertung der Klasse bzw. der Fehlergrenze (wenn keine Klassenangabe vorhanden ist) bezieht sich nur auf den konventionellen Wägewert.
The assessment of the class / the max. perm. error (if no class assessment is given) only refers to the conventional mass.

Fehler! Keine Dokumentvariable verfügbar.: | [Fehler! Keine Dokumentvariable verfügbar.] | ≤ [Fehler! Keine Dokumentvariable verfügbar.] – [Fehler! Keine Dokumentvariable verfügbar.]
Fehler! Keine Dokumentvariable verfügbar.: | [Fehler! Keine Dokumentvariable verfügbar.] | ≤ [Fehler! Keine

DAkkS calibration certificate for test weights (extract).
For more details on our calibration service and other useful information, please see the internet at www.kern-lab.com

1 Official document
2 Item to be calibrated
3 Traceability, see the *Glossory*
4 Identification/Applicant
5 Environmental conditions
6 Metrological component
7 Conventional mass
8 Uncertainty of measurement, see the *Glossory*

Traceable KERN test weights – Calibration of test weights

Calibrated measuring equipment requires calibrated checking equipment. For balances, these are calibrated test weights, also called "standard weights".

KERN will calibrate your test weights

- In all classes with permissible error limits E1–M3 according to OIML R111:2004 (for tolerance tables, see page 180), in sizes 1 mg to 2500 kg.
- With free nominal value
- Newton (N)
- Independent of design (special designs)

The advantages of using the KERN in-house calibration

You send your test weights to us.

- Excellent price performance ratio
- The quickest processing time
  - DAkkS standard service: 4 working days
  - DAkkS express service: 48 hrs (new weights)
- The most modern calibration methods with robot controlled comparators allow the most accurate calibration results and fastest throughput time
- KERN DAkkS calibration certificates are internationally recognised
- A calibration service which is independent of the brand
- KERN also reconditions existing customer weights (e.g. cleaning or readjustment)
- On request, we can also provide a pick-up and collection service with our parcel service

The advantages of using the KERN on-site calibration

We visit you.
We would be pleased to visit you within Germany and carry out the calibration of your reference standards to OIML classes M1–M3, 10 kg–2500 kg with permissible error limits, using our mobile MACOS system. Minimized downtime of your checking equipment and direct contact with our expert are the major benefits of this service. Price on request.

Recalibration

- The recalibration schedule depends on the frequency of use, the conditions of use and the safety requirements
- In terms of standardisation, no particular recalibration interval is specified
- We would recommend that you recalibrate your test weights every six months if they are used intensively, and every 12 months with normal use
- We would be pleased to monitor your recalibration schedule

Recalibration Price of Test Weights (DAkkS Calibration)

Class acc. →	E1[2] with volume determination		E1[1] without volume determination		E2[1]		F1/F2[1] * F2 only		M1/M2/M3[1]	
Nominal value ↓	**KERN**	**Price € excl. of VAT ex works**	**KERN**	**Price € excl. of VAT ex works**	**KERN**	**Price € excl. of VAT ex works**	**KERN**	**Price € excl. of VAT ex works**	**KERN**	**Price € excl. of VAT ex works**
1 mg	–	–	962-251R	**77,-**	962-351R	**34,-**	962-451R	**22,-**	962-651R	**18,-**
2 mg	–	–	962-252R	**77,-**	962-352R	**34,-**	962-452R	**22,-**	962-652R	**18,-**
5 mg	–	–	962-253R	**77,-**	962-353R	**34,-**	962-453R	**22,-**	962-653R	**18,-**
10 mg	–	–	962-254R	**77,-**	962-354R	**34,-**	962-454R	**22,-**	962-654R	**18,-**
20 mg	–	–	962-255R	**77,-**	962-355R	**34,-**	962-455R	**22,-**	962-655R	**18,-**
50 mg	–	–	962-256R	**77,-**	962-356R	**34,-**	962-456R	**22,-**	962-656R	**18,-**
100 mg	–	–	962-257R	**77,-**	962-357R	**34,-**	962-457R	**22,-**	962-657R	**18,-**
200 mg	–	–	962-258R	**77,-**	962-358R	**34,-**	962-458R	**22,-**	962-658R	**18,-**
500 mg	–	–	962-259R	**77,-**	962-359R	**34,-**	962-459R	**22,-**	962-659R	**18,-**
1 g	963-231	**245,-**	962-231R	**77,-**	962-331R	**34,-**	962-431R	**22,-**	962-631R	**18,-**
2 g	963-232	**245,-**	962-232R	**77,-**	962-332R	**34,-**	962-432R	**22,-**	962-632R	**18,-**
5 g	963-233	**245,-**	962-233R	**77,-**	962-333R	**34,-**	962-433R	**22,-**	962-633R	**18,-**
10 g	963-234	**245,-**	962-234R	**77,-**	962-334R	**34,-**	962-434R	**22,-**	962-634R	**18,-**
20 g	963-235	**245,-**	962-235R	**77,-**	962-335R	**34,-**	962-435R	**22,-**	962-635R	**18,-**
50 g	963-236	**245,-**	962-236R	**77,-**	962-336R	**34,-**	962-436R	**22,-**	962-636R	**18,-**
100 g	963-237	**245,-**	962-237R	**77,-**	962-337R	**43,-**	962-437R	**25,-**	962-637R	**20,-**
200 g	963-238	**245,-**	962-238R	**77,-**	962-338R	**43,-**	962-438R	**25,-**	962-638R	**20,-**
500 g	963-239	**245,-**	962-239R	**77,-**	962-339R	**43,-**	962-439R	**25,-**	962-639R	**20,-**
1 kg	963-241	**245,-**	962-241R	**77,-**	962-341R	**43,-**	962-441R	**25,-**	962-641R	**20,-**
2 kg	963-242	**550,-**	962-242R	**95,-**	962-342R	**52,-**	962-442R	**29,-**	962-642R	**21,-**
5 kg	963-243	**550,-**	962-243R	**95,-**	962-343R	**52,-**	962-443R	**29,-**	962-643R	**21,-**
10 kg	963-244	**550,-**	962-244R	**95,-**	962-344R	**52,-**	962-444R	**29,-**	962-644R	**21,-**
20 kg	963-245	**1280,-**	962-245R	**720,-**	962-345R	**68,-**	962-445R	**35,-**	962-645R	**27,-**
50 kg	963-246	**1500,-**	962-246R	**800,-**	962-346R	**79,-**	962-446R	**48,-**	962-646R	**29,-**
100 kg	–	–	–	–	–	–	962-591R*	**143,-**	962-691R	**77,-**
200 kg	–	–	–	–	–	–	962-592R*	**143,-**	962-692R	**77,-**
500 kg	–	–	–	–	–	–	962-593R*	**143,-**	962-693R	**77,-**
1000 kg	–	–	–	–	–	–	–	–	962-694R	**169,-**
2000 kg	–	–	–	–	–	–	–	–	962-695R	**310,-**
1 mg–500 mg	–	–	962-250R	**500,-**	962-350R	**235,-**	962-450R	**124,-**	962-650R	**77,-**
1 mg–50 g	963-201	**1400,-**	962-201R	**820,-**	962-301R	**385,–**	962-401R	**205,-**	962-601R	**132,-**
1 mg–100 g	963-202	**1520,-**	962-202R	**850,-**	962-302R	**425,–**	962-402R	**220,-**	962-602R	**138,-**
1 mg–200 g	963-203	**1750,-**	962-203R	**930,-**	962-303R	**485,–**	962-403R	**245,-**	962-603R	**155,-**
1 mg–500 g	963-204	**1860,-**	962-204R	**970,-**	962-304R	**520,–**	962-404R	**255,-**	962-604R	**162,-**
1 mg–1 kg	963-205	**1980,-**	962-205R	**1050,-**	962-305R	**560,–**	962-405R	**270,-**	962-605R	**170,-**
1 mg–2 kg	963-206	**2580,-**	962-206R	**1110,-**	962-306R	**610,–**	962-406R	**310,-**	962-606R	**187-**
1 mg–5 kg	963-207	**2890,-**	962-207R	**1160,-**	962-307R	**650,–**	962-407R	**325,-**	962-607R	**198,-**
1 mg–10 kg	963-208	**3290,-**	962-208R	**1200,-**	962-308R	**700,–**	962-408R	**355,-**	962-608R	**205,-**
1 g–50 g	963-215	**1010,-**	962-215R	**365,-**	962-315R	**159,–**	962-415R	**83,-**	962-615R	**51,-**
1 g–100 g	963-216	**1100,-**	962-216R	**395,-**	962-316R	**190,–**	962-416R	**95,-**	962-616R	**61,-**
1 g–200 g	963-217	**1340,-**	962-217R	**475,-**	962-317R	**250,–**	962-417R	**121,-**	962-617R	**75,-**
1 g–500 g	963-218	**1460,-**	962-218R	**520,-**	962-318R	**290,–**	962-418R	**135,-**	962-618R	**85,-**
1 g–1 kg	963-219	**1600,-**	962-219R	**560,-**	962-319R	**320,–**	962-419R	**148,-**	962-619R	**91,-**
1 g–2 kg	963-220	**2240,-**	962-220R	**640,-**	962-320R	**395,–**	962-420R	**186,-**	962-620R	**110,-**
1 g–5 kg	963-221	**2620,-**	962-221R	**660,-**	962-321R	**445,–**	962-421R	**205,-**	962-621R	**119,-**
1 g–10 kg	963-222	**3060,-**	962-222R	**720,-**	962-322R	**480,–**	962-422R	**225,-**	962-622R	**128,-**

[1] Processing time 4 working days, [2] Processing time 15 working days, [1] Preparation of reverification of balances, 969-006R, **€ 25,-**

Additional costs for preparation, overhaul and adjustment before the calibration	**KERN**	**Price excl. of VAT ex works €**
Preparation of weights (e.g. cleaning, etc.)		
Single weight	969-001R	**5,-**
Weight set	969-002R	**20,-**
Subsequent services are carried out after confirmation		
Continued overhaul of weights (e.g. wet-cleaning, markings, repair, special packaging, adjustment E1 (DAkkS only), E2 ...)	969-005R	**T & M basis**
Adjustment, per weight only available for weights with adjustment chamber (F1–M3)	969-010R	**15,-**
Second calibration after adjustment or substitution, per weight		
Class E1	969-210R	**63,-**
Class E1 incl. volume determination	969-211R	**230,-**
Class E2	969-310R	**30,-**
Class F1/F2	969-410R	**20,-**
Class M1–M3	969-610R	**16,-**
Testing of magnetic properties according to OIML R111:2004, per weight	961-115R	**15,-**
Calibration of NON-OIML test weights, additional price per weight	–	**8,-**

KERN DAkkS Express Service*[1]

DAkkS standard service Class E2–M3	4 working days
DAkkS standard service Class E1, 1 mg–500 mg, and recalibration 1 g–10 kg with a known volume	10 working days
Class E1, ≥ 1 g, incl. volume determination (new weights)	15 working days

*[1] The delivery time for recalibrations can vary depending on the order situation as well as in case of queries, bottlenecks, etc.

DAkkS Express service in 48 hours
except for class E1

- Urgent order is received at KERN by 12:00 noon at the latest
- Ready for shipping at KERN within two working days, at 12:00 noon
- Return by standard parcel service or express shipping (Costs and processing time on request)
- Additional cost for DAkkS Express Service, for each KERN test weight KERN KERN 962-115 **€ 21,–**
- For Express shipping, see page 226

Class acc. → OIML R111:2004	E2[1] with verification certificate		F1[1] with verification certificate		M1[1] with verification certificate	
Nominal value ↓	**KERN**	**Price € excl. of VAT ex works**	**KERN**	**Price € excl. of VAT ex works**	**KERN**	**Price € excl. of VAT ex works**
1 mg	952-351	**54,-**	952-451	**46,-**	952-651	**32,-**
2 mg	952-352	**54,-**	952-452	**46,-**	952-652	**32,-**
5 mg	952-353	**54,-**	952-453	**46,-**	952-653	**32,-**
10 mg	952-354	**54,-**	952-454	**46,-**	952-654	**32,-**
20 mg	952-355	**54,-**	952-455	**46,-**	952-655	**32,-**
50 mg	952-356	**54,-**	952-456	**46,-**	952-656	**32,-**
100 mg	952-357	**54,-**	952-457	**46,-**	952-657	**32,-**
200 mg	952-358	**54,-**	952-458	**46,-**	952-658	**32,-**
500 mg	952-359	**54,-**	952-459	**46,-**	952-659	**32,-**
1 g	952-331	**54,-**	952-431	**46,-**	952-631	**32,-**
2 g	952-332	**54,-**	952-432	**46,-**	952-632	**32,-**
5 g	952-333	**54,-**	952-433	**46,-**	952-633	**32,-**
10 g	952-334	**54,-**	952-434	**46,-**	952-634	**32,-**
20 g	952-335	**54,-**	952-435	**46,-**	952-635	**32,-**
50 g	952-336	**54,-**	952-436	**46,-**	952-636	**32,-**
100 g	952-337	**60,-**	952-437	**46,-**	952-637	**32,-**
200 g	952-338	**60,-**	952-438	**48,-**	952-638	**32,-**
500 g	952-339	**60,-**	952-439	**48,-**	952-639	**32,-**
1 kg	952-341	**60,-**	952-441	**48,-**	952-641	**32,-**
2 kg	952-342	**68,-**	952-442	**54,-**	952-642	**34,-**
5 kg	952-343	**68,-**	952-443	**54,-**	952-643	**34,-**
10 kg	952-344	**68,-**	952-444	**54,-**	952-644	**42,-**
20 kg	952-345	**79,-**	952-445	**56,-**	952-645	**48,-**
50 kg	-	**-**	952-446	**67,-**	952-646	**50,-**
1 mg–500 mg	952-350	**270,-**	952-450	**141,-**	952-650	**88,-**
1 mg–50 g	952-301	**440,-**	952-401	**230,-**	952-601	**147,-**
1 mg–100 g	952-302	**480,-**	952-402	**250,-**	952-602	**156,-**
1 mg–200 g	952-303	**540,-**	952-403	**280,-**	952-603	**174,-**
1 mg–500 g	952-304	**580,-**	952-404	**290,-**	952-604	**183,-**
1 mg–1 kg	952-305	**600,-**	952-405	**305,-**	952-605	**192,-**
1 mg–2 kg	952-306	**690,-**	952-406	**345,-**	952-606	**210,-**
1 mg–5 kg	952-307	**750,-**	952-407	**375,-**	952-607	**225,-**
1 mg–10 kg	952-308	**790,-**	952-408	**400,-**	952-608	**230,-**
1 g–50 g	952-315	**176,-**	952-415	**102,-**	952-615	**67,-**
1 g–100 g	952-316	**210,-**	952-416	**108,-**	952-616	**71,-**
1 g–200 g	952-317	**275,-**	952-417	**138,-**	952-617	**85,-**
1 g–500 g	952-318	**315,-**	952-418	**152,-**	952-618	**94,-**
1 g–1 kg	952-319	**340,-**	952-419	**167,-**	952-619	**104,-**
1 g–2 kg	952-320	**425,-**	952-420	**210,-**	952-620	**124,-**
1 g–5 kg	952-321	**470,-**	952-421	**230,-**	952-621	**135,-**
1 g–10 kg	952-322	**520,-**	952-422	**255,-**	952-622	**145,-**

KERN verification delivery time

Standard verification service Class E2 – M1	6 working days

Additional costs for preparation, overhaul and adjustment before the verification	**KERN**	**Price excl. of VAT ex works €**
Preparation of weights (e.g. cleaning, etc.)		
Single weight	969-008R	**5,-**
Weight set	969-009R	**19,-**
Subsequent services are carried out after confirmation		
Continued overhaul of weights (e.g. wet-cleaning, markings, repair, special packaging, adjustment E2 ...)	969-005R	**T & M basis**
Adjustment, per weight only available for weights with adjustment chamber (F1/F2 – M1)	969-010R	**15,-**
Verification after adjustment or substitution, per weight		
Class E2	969-310R	**30,-**
Class F1/F2	969-410R	**20,-**
Class M1	969-610R	**16,-**

Verification prices for balances	**Reverification KERN**	**Price excl. of VAT ex works €**
Accuracy class I (precision balances) [1]		
[Max] ≤ 5 kg [1]	950-101R	**235,-**
[Max] > 5 kg [1]	950-102R	**305,-**
Accuracy class II (precision balances) [1]		
[Max] ≤ 5 kg [1]	950-116R	**120,-**
[Max] > 5 kg – 50 kg [1]	950-117R	**146,-**
[Max] > 50 kg – 350 kg [1]	950-118R	**225,-**
Accuracy class III-IV [1]		
Bench scales and industrial scales (excl. crane scales)		
[Max] ≤ 5 kg [1]	950-127R	**114,-**
[Max] > 5 kg – 50 kg [1]	950-128R	**114,-**
[Max] > 50 kg – 350 kg [1]	950-129R	**184,-**
[Max] > 350 kg – 1500 kg [1]	950-130R	**270,-**
[Max] > 1500 kg – 2900 kg [1]	950-131R	**375,-**
[Max] > 2900 kg – 6000 kg [1]	950-132R	**580,-**
Crane scales		
[Max] > 50 kg – 350 kg [1]	950-129HR	**200,-**
[Max] > 350 kg – 1500 kg [1]	950-130HR	**330,-**
[Max] > 1500 kg – 2900 kg [1]	950-131HR	**480,-**
[Max] > 2900 kg – 6000 kg [1]	950-132HR	**720,-**
[Max] > 6000 kg – 12000 kg [1]	950-133HR	**1160,-**

[1] Processing time 4 working days, [2] Processing time 15 working days, [1] Preparation of reverification of balances, 969-006R, **€ 25,-**

Accredited calibration with DAkkS calibration certificate for force gauges

The KERN calibration laboratory is at your side when you need to calibrate according to DAkkS. From the transducer to the full measuring chain, we are happy to take care of traceable calibration of your test equipment for you.

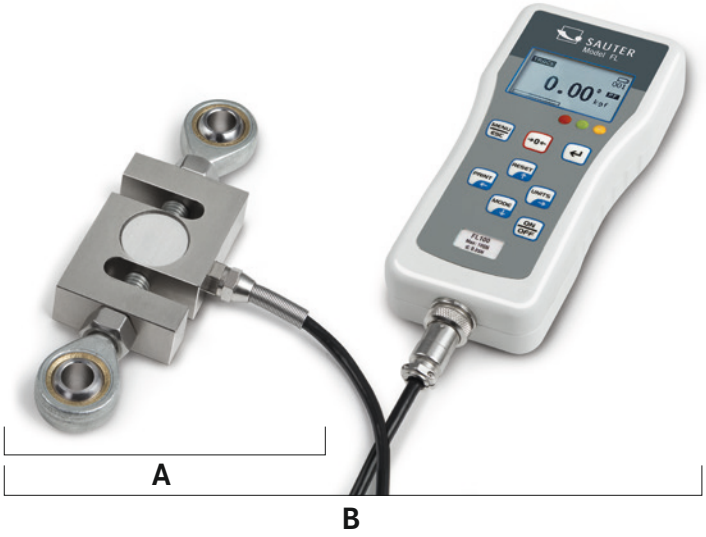
Our accreditation includes the calibration of tensile and pressure force up to 5 kN according to the standards DIN EN ISO 376 and DKD-R 3-3, each with the Newton (N) display unit for a complete measuring chain (situation A) or voltage ratio/transmission coefficient (mV/V, situation B).

Below you will find a comparison of which standard meets which criteria:

Comparison of DIN EN ISO 376 and DKD-R 3-3

	ISO 376	DKD-R 3-3
Standardization	ISO standard (internationally standardized)	Standard of the DKD (Germany)
Measuring equipment	Force transducers and complete measuring chains	Force transducers and complete measuring chains
Area of application	Specifically force gauges for the testing of testing equipment	General force gauges
Number of power stages	8	5
Classification/Assessment	Classification in classes 00; 0,5; 1 and 2	None in standard
Test sequences	Fixed procedure	Sequences A, B, C, D possible Standard is sequence A B, C and D are reduced sequences, relevant previous knowledge is necessary
Summary	Higher-quality calibration, as 8 force levels are calibrated	High-quality calibration, reduced sequences with less effort possible

We can offer you a calibration solution for the following situations:



Situation A:
Separate force transducer,
display unit mV/V

Situation B:
Complete force gauge (N),
consisting of transducer, amplifier and display, display unit N

▸ See also tables, right side

You can find further information on this topic at: **www.kern-lab.com**

KERN CALIBRATION
KERN & SOHN GmbH
Akkreditiertes Kalibrierlabor seit 1994.
Accredited calibration laboratory since 1994.
Ihr Partner für Kalibrierdienstleistungen, Prüfmittelmanagement und Beratung.
Your partner for calibration services, test equipment management and support.

Mitglied im / member of the
Deutschen Kalibrierdienst DKD

Kalibrierschein Calibration Certificate: Sample-2023-01/1
Kalibrierzeichen Calibration mark: Sample D-K-19408-01-00 2023-01

Gegenstand / Object: Kraftmessgerät / Force gauge, Max 1000 N, d= 0,5 N
Hersteller / Manufacturer: Sauter GmbH, Ziegelei 1, 72336 Balingen, Deutschland
Typ / Type: FH 1K
Seriennummer / Serial number: 5A20H02287
Auftraggeber / Customer: Musterfirma GmbH, Musterstraße 1

Messwerte (Zugkraft) / Measurement results (tension force)

Ausrichtung rotation	Ausgangsposition / initial position 0°		120°		240°	
Kraft force	R1	R2	R3	R4'	R5	R6'
0 N	0,0 N	0,0 N	0,0 N	0,0 N	0,0 N	0,0 N
200,0 N	-199,5 N	-199,5 N	-199,5 N	-200,0 N	-199,5 N	-200,0 N
400,0 N	-399,5 N	-399,5 N	-399,5 N	-399,5 N	-399,5 N	-399,5 N
600,0 N	-599,5 N	-599,5 N	-599,5 N	-599,5 N	-599,5 N	-599,5 N
800,0 N	-799,0 N	-799,0 N	-799,0 N	-799,5 N	-799,0 N	-799,5 N
1000,0 N	-998,5 N	-999,0 N	-999,0 N	-999,0 N	-999,0 N	-999,0 N
0 N	0,0 N	0,0 N				

Messergebnisse (Zugkraft) / Measured values (tension force)

Aus den oben aufgeführten Messwerten ergeben sich die folgenden Messergebnisse:
The following measurement results are calculated using the measured values above:

Rel. Kalibrierendwertabweichung / *Rel. cal. max. load error:* b_f = 0,000 %
Rel. Nullpunktabweichungen / *Rel. zero error:* f_0 = 0,000 % (R1), 0,000 % (R2), 0,000 % (R3/R4'), 0,000 % (R5/R6')

Kraft force	arith. Mittelwert $\bar{x}_r$ average $\bar{x}_r$	rel. Wiederholpräzision b' rel. repeatability b'	rel. Vergleichspräzision b rel. reproducibility b	rel. Umkehrspanne v hysteresis v
200,0 N	-199,5 N	0,000 %	0,000 %	+0,251 %
400,0 N	-399,5 N	0,000 %	0,000 %	0,000 %
600,0 N	-599,5 N	0,000 %	0,000 %	0,000 %
800,0 N	-799,0 N	0,000 %	0,000 %	+0,063 %
1000,0 N	-998,8 N	+0,050 %	+0,050 %	0,000 %

Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardmessunsicherheit durch Multiplikation mit dem Erweiterungsfaktor k = 2 ergibt. Sie wurde gemäß EA-4/02 M: 2022 und DKD-R 3-3 ermittelt und gilt jeweils für Belastungen zwischen der angegebenen Kraftstufe und der Kalibrierhöchstkraft. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von mindestens 95% im zugeordneten Werteintervall.

DAkkS Calibration certificate for force-measuring devices (extract).

Prices for DAkkS calibration of force gauges and force transducers

Situation A: Force transducer (voltage ratio, in mV/V)*1,2

	ISO 376 (8 stages)			DKD-R 3-3 (5 stages, sequence A)	
KERN	**Measuring range**	**Price € ex works excl. of VAT**	**KERN**	**Measuring range**	**Price € ex works excl. of VAT**
Tensile force:					
963-161IV (R)	≤ 500 N	**240,-**	963-161V (R)	≤ 500 N	**225,-**
963-162IV (R)	≤ 2 kN	**285,-**	963-162V (R)	≤ 2 kN	**265,-**
963-163IV (R)	≤ 5 kN	**370,-**	963-163V (R)	≤ 5 kN	**345,-**
Compression force:					
963-261IV (R)	≤ 500 N	**240,-**	963-261V (R)	≤ 500 N	**225,-**
963-262IV (R)	≤ 2 kN	**285,-**	963-262V (R)	≤ 2 kN	**265,-**
963-263IV (R)	≤ 5 kN	**370,-**	963-263V (R)	≤ 5 kN	**345,-**
Tensile and Compression force:					
963-361IV (R)	≤ 500 N	**400,-**	963-361V (R)	≤ 500 N	**370,-**
963-362IV (R)	≤ 2 kN	**475,-**	963-362V (R)	≤ 2 kN	**445,-**
963-363IV (R)	≤ 5 kN	**640,-**	963-363V (R)	≤ 5 kN	**580,-**

Situation B: Complete force gauge (in N)*2

	ISO 376 (8 stages)			DKD-R 3-3 (5 stages, sequence A)	
KERN	**Measuring range**	**Price € ex works excl. of VAT**	**KERN**	**Measuring range**	**Price € ex works excl. of VAT**
Tensile force:					
963-161I (R)	≤ 500 N	**178,-**	963-161 (R)	≤ 500 N	**178,-**
963-162I (R)	≤ 2 kN	**240,-**	963-162 (R)	≤ 2 kN	**215,-**
963-163I (R)	≤ 5 kN	**330,-**	963-163 (R)	≤ 5 kN	**300,-**
Compression force:					
963-261I (R)	≤ 500 N	**197,-**	963-261 (R)	≤ 500 N	**178,-**
963-262I (R)	≤ 2 kN	**240,-**	963-262 (R)	≤ 2 kN	**215,-**
963-263I (R)	≤ 5 kN	**330,-**	963-263 (R)	≤ 5 kN	**300,-**
Tensile and Compression force:					
963-361I (R)	≤ 500 N	**355,-**	963-361 (R)	≤ 500 N	**325,-**
963-362I (R)	≤ 2 kN	**440,-**	963-362 (R)	≤ 2 kN	**400,-**
963-363I (R)	≤ 5 kN	**590,-**	963-363 (R)	≤ 5 kN	**530,-**

Factory calibration for force

This is not an accredited calibration (no proof of metrological traceability).

Situation A: Force transducer (voltage ratio, in mV/V)*1,2 **Situation B: Complete force gauge (in N)*2**

KERN	Measuring range	Price € ex works excl. of VAT	KERN	Measuring range	Price € ex works excl. of VAT
Tensile force:					
961-161V (R)	≤ 500 N	**225,-**	961-161 (R)	≤ 500 N	**178,-**
961-162V (R)	≤ 2 kN	**265,-**	961-162 (R)	≤ 2 kN	**215,-**
961-163V (R)	≤ 5 kN	**345,-**	961-163 (R)	≤ 5 kN	**300,-**
961-164V (R)	≤ 20 kN	**440,-**	961-164 (R)	≤ 20 kN	**390,-**
961-165V (R)	≤ 50 kN	**440,-**	961-165 (R)	≤ 50 kN	**390,-**
961-166V (R)	≤ 250 kN	**470,-**	961-166 (R)	≤ 250 kN	**435,-**
Compression force:					
961-261V (R)	≤ 500 N	**225,-**	961-261 (R)	≤ 500 N	**178,-**
961-262V (R)	≤ 2 kN	**265,-**	961-262 (R)	≤ 2 kN	**215,-**
961-263V (R)	≤ 5 kN	**345,-**	961-263 (R)	≤ 5 kN	**300,-**
961-264V (R)	≤ 20 kN	**440,-**	961-264 (R)	≤ 20 kN	**390,-**
961-265V (R)	≤ 50 kN	**440,-**	961-265 (R)	≤ 50 kN	**390,-**
961-266V (R)	≤ 250 kN	**470,-**	961-266 (R)	≤ 250 kN	**435,-**
Tensile and Compression force:					
961-361V (R)	≤ 500 N	**370,-**	961-361 (R)	≤ 500 N	**325,-**
961-362V (R)	≤ 2 kN	**445,-**	961-362 (R)	≤ 2 kN	**400,-**
961-363V (R)	≤ 5 kN	**580,-**	961-363 (R)	≤ 5 kN	**530,-**
961-364V (R)	≤ 20 kN	**630,-**	961-364 (R)	≤ 20 kN	**580,-**
961-365V (R)	≤ 50 kN	**630,-**	961-365 (R)	≤ 50 kN	**580,-**
961-366V (R)	≤ 250 kN	**690,-**	961-366 (R)	≤ 250 kN	**640,-**

(R): Recalibration

For each force gauge without interface or from other manufacturers we charge a surcharge of € 10,- for the additional effort.

*1 Compatibility with our amplifiers required

*2 Installation in our measuring equipment required

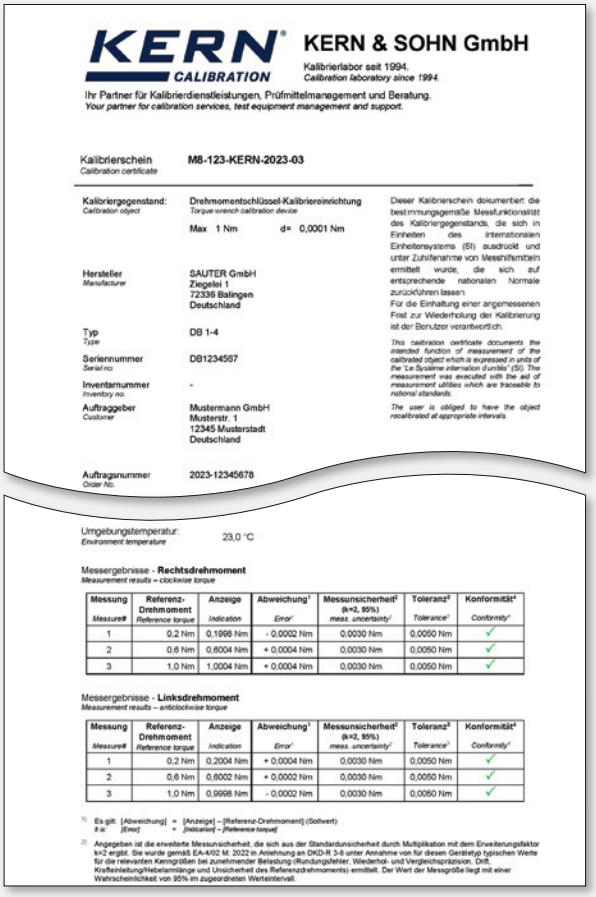
Factory calibration certificates

As DAkkS calibration certificates cannot be offered for all measuring devices or measurement sizes, or where it is not customary, we then offer factory calibration certificates. This is not an accredited calibration (no proof of metrological traceability). These calibration certificates meet international standards and are particularly suitable as proof of exacting calibration in the monitoring of your checking equipment, for example:

- Mechanical balances (spring balances, etc.)
- Force-measuring devices up to 250 kN (see also page 221)
- Measuring devices for layer thickness 0 µm – 2000 µm
- Hardness testing devices in accordance with Leeb tests
- Ultrasonic material thickness testing device 25 mm - 300 mm

We carry out calibrations independent of brand. In order to avoid any unnecessary delays when processing your order, please send us the technical documents and necessary accessories with the checking device. Calibration time 4 working days.

For up-to-date information on test services for further measuring variables please see p. 231 or visit our website www.kern-lab.com



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Kalibrierschein
Calibration certificate
M8-123-KERN-2023-03

Kalibriergegenstand: *Calibration object* — Drehmomentschlüssel-Kalibriereinrichtung *Torque wrench calibration device*
Max 1 Nm d= 0,0001 Nm

Hersteller *Manufacturer*: SAUTER GmbH, Ziegelei 1, 72336 Balingen, Deutschland
Typ *Type*: DB 1-4
Seriennummer *Serial no.*: DB1234567
Inventarnummer *Inventory no.*: -
Auftraggeber *Customer*: Mustermann GmbH, Musterstr. 1, 12345 Musterstadt, Deutschland
Auftragsnummer *Order No.*: 2023-12345678

Dieser Kalibrierschein dokumentiert die bestimmungsgemäße Messfunktionalität des Kalibriergegenstands, die sich in Einheiten des internationalen Einheitensystems (SI) ausdrückt und unter Zuhilfenahme von Messhilfsmitteln ermittelt wurde, die sich auf entsprechende nationalen Normale zurückführen lassen.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the intended function of measurement of the calibrated object which is expressed in units of the "Le Système international d'unités" (SI). The measurement was executed with the aid of measurement utilities which are traceable to national standards.
The user is obliged to have the object recalibrated at appropriate intervals.

Umgebungstemperatur: *Environment temperature* 23,0 °C

Messergebnisse - **Rechtsdrehmoment**
Measurement results – clockwise torque

Messung *Measure#*	Referenz-Drehmoment *Reference torque*	Anzeige *Indication*	Abweichung[1] *Error*	Messunsicherheit[2] (k=2, 95%) *meas. uncertainty*	Toleranz[3] *Tolerance*	Konformität[4] *Conformity*
1	0,2 Nm	0,1998 Nm	- 0,0002 Nm	0,0030 Nm	0,0050 Nm	✓
2	0,6 Nm	0,6004 Nm	+ 0,0004 Nm	0,0030 Nm	0,0050 Nm	✓
3	1,0 Nm	1,0004 Nm	+ 0,0004 Nm	0,0030 Nm	0,0050 Nm	✓

Messergebnisse - **Linksdrehmoment**
Measurement results – anticlockwise torque

Messung *Measure#*	Referenz-Drehmoment *Reference torque*	Anzeige *Indication*	Abweichung[1] *Error*	Messunsicherheit[2] (k=2, 95%) *meas. uncertainty*	Toleranz[3] *Tolerance*	Konformität[4] *Conformity*
1	0,2 Nm	0,2004 Nm	+ 0,0004 Nm	0,0030 Nm	0,0050 Nm	✓
2	0,6 Nm	0,6002 Nm	+ 0,0002 Nm	0,0030 Nm	0,0050 Nm	✓
3	1,0 Nm	0,9998 Nm	- 0,0002 Nm	0,0030 Nm	0,0050 Nm	✓

[1] Es gilt: [Abweichung] = [Anzeige] – [Referenz-Drehmoment] (Sollwert)
It is: [Error] = [Indication] – [Reference torque]

[2] Angegeben ist die erweiterte Messunsicherheit, die sich aus der Standardunsicherheit durch Multiplikation mit dem Erweiterungsfaktor k=2 ergibt. Sie wurde gemäß EA-4/02 M: 2022 in Anlehnung an DKD-R 3-6 unter Annahme von für diesen Gerätetyp typischen Werte für die relevanten Kenngrößen bei zunehmender Belastung (Rundungsfehler, Wiederhol- und Vergleichspräzision, Drift, Krafteinleitung/Hebelarmlänge und Unsicherheit des Referenzdrehmoments) ermittelt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95% im zugeordneten Wertintervall.

Factory calibration certificate for torque wrench test devices (extract from the factory calibration certificate) **Further details on the internet at www.kern-lab.com**

KERN	Measuring device	Measuring range	Price excl. of VAT ex works €
Factory calibration			
961-110	Coating thickness	≤ 2000 µm F or N	**159,–**
961-112	Coating thickness	≤ 2000 µm FN	**225,–**
961-113	Wall thickness (ultra sound)	≤ 300 mm (in stainless steel)	**159,–**
961-114	Wall thickness (Test blocks)	≤ 300 mm	**198,–**
961-170	Hardness comparison plate (Shore)	For sets up to 7 plates	**126,–**
961-131	Hardness tester (Leeb)	400 – 800 HLD	**159,–**
961-132	Hardness comparison plate (Leeb)	Hardness comparison plate (for Leeb durometer)	**159,–**
961-270	Hardness (UCI)	200 - 800 HV	**345,–**
961-150	Length	≤ 300 mm	**159,–**
961-190	Light	≤ 200000 lx	**308,–**
961-100	Mechanical balances/ spring balances	≤ 5 kg	**94,–**
961-101	Mechanical balances/ spring balances	> 5 – 50 kg	**117,–**
961-102	Mechanical balances/ spring balances	> 50 – 350 kg	**139,–**
961-103	Mechanical balances/ spring balances	> 350 – 1500 kg	**215,–**
961-102K	Digital dynamometer KERN MAP	≤ 130 kg	**159,–**
961-120 (R)	Torque wrench test devices	1 Nm - 200 Nm	**225,-**
964-305	Temperature calibration for moisture analyzer*		**174,-**
Additional services			
962-116	Express service with 48 hour delivery		**52,–**/ instrument

(R): Recalibration
For each force gauge without interface or from other manufacturers we charge a surcharge of € 10,- for the additional effort.

*Calibration available for the following models:
DAB 100-3, DAB 200-2, DBS 60-3, DLB 160-3A, DLT 100-3N, MLS 50-3D, MLS 50-3C, MLB 50-3C, MLB 50-3N, MLB 50-3, MLS 50-3.

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