Test weights

Weights yesterday and today

Weights have always been used to carry out weighing procedures. This original purpose has almost disappeared. Today, weights are used almost exclusively for adjusting and testing = calibration of electronic balances. We therefore call them "Test weights" as this is their purpose of use.

Adjustment or calibration?

➔ *Adjusting* a balance means that you are intervening in the weighing system, to make sure that the display is set to show the correct nominal value. With ➔ *calibration,* on the other hand, there is no intervention, you are testing whether the display is correct and documenting any deviation.

Testing, the right way!

The internationally valid OIML norm R111-2004 classifies test weights hierarchically in accuracy classes, where E1 is the most accurate and M3 is the least accurate weight class. With KERN you get the whole test weight range in all OIML accuracy classes E1, E2, F1, F2, M1, M2, M3.

As the appropriate test weight is only classed as checking equipment according to ➔ *ISO 9000ff* if it has the relevant proof of accuracy, all KERN test weights come with an appropriate ➔ *DAkkS-calibration certificate*. For further details, see the calibration service section on page 185.

KERN offers you the appropriate test weight package for your balance, consisting of the test weight, box and DAkkS-calibration certificate, as proof of its accuracy. The best pre-requisite for proper balance calibration.

➔ *See the glossary on page 191 – 192*

Test weights: classes of accuracy E, F, M and their general relation to the types of balances:

E1   Test weights for customers who require a high degree of accuracy for the most demanding applications. For high-resolution balances with d > 1,000,000 Use recommended with DAkkS calibration certificate only.

E2   Most accurate test weights for high resolution analytical balances of verification class I ≥ 100,000 e

F1   Test weights for analytical balances / precision balances for verification class I / II ≤ 100,000 e

F2   Test weights for precision balances of verification class II, ≤ 30,000 e

M1   Test weights for industrial and commercial scales of verification class III ≤ 10,000 e

Selection of the appropriate test weight for your balance

Correctly selected test weights with DAkkS calibration certificate are the pre-requisite for ensuring that your balances are not only correctly adjusted, but also correctly calibrated. Scheduled testing of your balances with such test weights helps to guarantee your quality requirements and to maintain your quality targets.

Here's how you find the right test weight for your balance:
A balance can never be more accurate than the test weight used to adjust it, it all depends on its tolerance.
Accuracy of the test weight: Should correspond to the readout [d] of the balance, or rather be better.

Nominal weight value: This is shown in adjust mode "CAL" in the balance display. Given a choice, the heaviest weight is the most suitable for accurate measurement.
Once accuracy and nominal weight value are specified, the suitable test weight is selected according to the tolerances "Tol" of the individual accuracy classes E2 – M3, see column "Tol ± mg" at the respective weight and table at page 167.

Example:
Balance with weighing range [Max] 2000 g = 2 kg
and readout [d] = 0,01 g = 10 mg

- The accuracy of the required test weight is determined by readout [d] with approx. ± 10 mg.

- Displayed weight size on "CAL" mode: 1000 g or 2000 g. The required test weight has a 2 kg weight size.

- Suitable test weights with ± 10 mg tolerance and 2 kg weight size, can be found in accuracy class F1. KERN-No 327-72, see page 172.

Exception, analytical balances (readout [d] ≤ 0,1 mg):
E1 test weights are recommended. Depending on the safety requirements, E2 test weights with a DAkkS calibration certificate will also be sufficient.

From brass to stainless steel - the right test weight for every situation

Test weight → Features ↓	Cylindrical shape with lifting knob, polished stainless steel	Compact shape with carrying grip, polished stainless steel	Cylindrical shape with lifting knob, polished stainless steel or nickelplated and polished brass	Compact shape with carrying grip, finely turned stainless steel	Cylindrical shape with lifting knob, finely turned stainless steel	Cylindrical shape with lifting knob, finely turned brass
conforms to OIML R111	yes	yes	yes	no	yes	yes
Available classes	E1, E2	E2, F1	F1	adjusted to F1 error limit class	F2, M1	M1, M2, M3
Upper surface	polished	polished	polished	finely turned	finely turned	finely turned
Material	Stainless steel	Stainless steel	Stainless steel or nickel-plated brass	Stainless steel	Stainless steel	Brass
Adjusting cavity	no	no	yes	yes, from 20 g	yes, from 20 g	yes, from 20 g
Verification possible	yes	yes	yes	nein	yes	yes, except M2
Checking equipment for verification purposes	approved	approved	approved	not approved	approved	approved
Ideal as checking equipment in QM systems (e.g. ISO 9000 ff)	yes	yes	yes	yes	yes	yes
Benefits	• High-quality test weight for analytical and precision balances • Highly-refined surface • Ideal shape of the top for good grip	• Affordable test weight for analytical and precision balances • Highly-refined surface	• Ideal, high-quality test weight for precision balances • Ideal shape of the top for good grip	• Affordable test weight for in-house checking of precision balances	• Ideal test weight for commercial and industrial scales • Ideal shape of the top for good grip	• Affordable test weight for commercial and industrial scales • Ideal shape of the top for good grip

OIML norm R111-2004 for weights

The key points from the OIML norm R111-2004
OIML (Organisation Internationale de Metrologie Legale) has established the exact metrological requirements for weights in verified applications in approx. 100 states all over the world. The OIML recommendation R111 (2004 Edition) for weights relates to sizes 1 mg – 50 kg. Statements are made on the accuracy, materials, geometric shape, marking and storage of the weights.

Error limits for weights of classes E1 to M3
The error limit classes are in fixed hierarchical levels in the proportion of 1:3, where E1 is the most accurate and M3 is the least accurate weight class. When testing weights with other weights, the correct test class is the next highest class.

Error limit classes (= tolerances)
The values given in the table below (tolerances ± ... mg) are the respective permitted fabrication tolerances. They are to be equal to the ➔ *measuring uncertainty* of the weight, if no ➔ *DAkkS calibration certificate* is available.

Conventional mass
The problem is the air buoyancy, which makes the weight appear lighter. In order to avoid this "distortion" in daily use, all weights are adjusted to the unit specifications as given in R111, i.e. it is accepted that: material density of the weights is 8000 kg / m^3, air density is 1.2 kg / m^3 and measuring temperature is 20 °C.

KERN cylindrical test weights
Comply with OIML R111-2004 in all respects, without exception.

➔ *See the glossary, page 191 – 192*

Nominal value	OIML R111-2004 Maximum permissible errors for weights = permissible tolerances "Tol ± mg"						
↓	E1	E2	F1	F2	M1	M2	M3
1 mg	± 0,003 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	-	-
2 mg	± 0,003 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	-	-
5 mg	± 0,003 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	-	-
10 mg	± 0,003 mg	± 0,008 mg	± 0,025 mg	± 0,08 mg	± 0,25 mg	-	-
20 mg	± 0,003 mg	± 0,010 mg	± 0,03 mg	± 0,10 mg	± 0,3 mg	-	-
50 mg	± 0,004 mg	± 0,012 mg	± 0,04 mg	± 0,12 mg	± 0,4 mg	-	-
100 mg	± 0,005 mg	± 0,016 mg	± 0,05 mg	± 0,16 mg	± 0,5 mg	± 1,6 mg	-
200 mg	± 0,006 mg	± 0,020 mg	± 0,06 mg	± 0,20 mg	± 0,6 mg	± 2,0 mg	-
500 mg	± 0,008 mg	± 0,025 mg	± 0,08 mg	± 0,25 mg	± 0,8 mg	± 2,5 mg	-
1 g	± 0,010 mg	± 0,03 mg	± 0,10 mg	± 0,3 mg	± 1,0 mg	± 3,0 mg	± 10 mg
2 g	± 0,012 mg	± 0,04 mg	± 0,12 mg	± 0,4 mg	± 1,2 mg	± 4,0 mg	± 12 mg
5 g	± 0,016 mg	± 0,05 mg	± 0,16 mg	± 0,5 mg	± 1,6 mg	± 5,0 mg	± 16 mg
10 g	± 0,020 mg	± 0,06 mg	± 0,20 mg	± 0,6 mg	± 2,0 mg	± 6,0 mg	± 20 mg
20 g	± 0,025 mg	± 0,08 mg	± 0,25 mg	± 0,8 mg	± 2,5 mg	± 8,0 mg	± 25 mg
50 g	± 0,03 mg	± 0,10 mg	± 0,3 mg	± 1,0 mg	± 3,0 mg	± 10 mg	± 30 mg
100 g	± 0,05 mg	± 0,16 mg	± 0,5 mg	± 1,6 mg	± 5,0 mg	± 16 mg	± 50 mg
200 g	± 0,10 mg	± 0,3 mg	± 1,0 mg	± 3,0 mg	± 10 mg	± 30 mg	± 100 mg
500 g	± 0,25 mg	± 0,8 mg	± 2,5 mg	± 8,0 mg	± 25 mg	± 80 mg	± 250 mg
1 kg	± 0,5 mg	± 1,6 mg	± 5,0 mg	± 16 mg	± 50 mg	± 160 mg	± 500 mg
2 kg	± 1,0 mg	± 3,0 mg	± 10 mg	± 30 mg	± 100 mg	± 300 mg	± 1 000 mg
5 kg	± 2,5 mg	± 8,0 mg	± 25 mg	± 80 mg	± 250 mg	± 800 mg	± 2 500 mg
10 kg	± 5,0 mg	± 16 mg	± 50 mg	± 160 mg	± 500 mg	± 1 600 mg	± 5 000 mg
20 kg	± 10 mg	± 30 mg	± 100 mg	± 300 mg	± 1 000 mg	± 3 000 mg	± 10 g
50 kg	± 25 mg	± 80 mg	± 250 mg	± 800 mg	± 2 500 mg	± 8 000 mg	± 25 g
100 kg	-	± 160 mg	± 500 mg	± 1 600 mg	± 5 000 mg	± 16 g	± 50 g
200 kg	-	± 300 mg	± 1 000 mg	± 3 000 mg	± 10 g	± 30 g	± 100 g
500 kg	-	± 800 mg	± 2 500 mg	± 8 000 mg	± 25 g	± 80 g	± 250 g
1 000 kg	-	± 1 600 mg	± 5 000 mg	± 16 g	± 50 g	± 160 g	± 500 g
2 000 kg	-	-	± 10 g	± 30 g	± 100 g	± 300 g	± 1 000 g
5 000 kg	-	-	± 25 g	± 80 g	± 250 g	± 800 g	± 2 500 g

Composition table, valid for all KERN weight sets from 1 mg

Individual weights per set ➔	1 mg	2 mg	2 mg	5 mg	10 mg	20 mg	20 mg	50 mg	100 mg	200 mg	200 mg	500 mg	1 g	2 g	2 g	5 g	10 g	20 g	20 g	50 g	100 g	200 g	200 g	500 g	1 kg	2 kg	2 kg	5 kg	10 kg
Weight set ↓																													

Weight set	Total weight
1 mg – 500 mg	1,11 g
1 mg – 50 g	111,11 g
1 mg – 100 g	211,11 g
1 mg – 200 g	611,11 g
1 mg – 500 g	1.111,11 g
1 mg – 1 kg	2.111,11 g
1 mg – 2 kg	6.111,11 g
1 mg – 5 kg	11.111,11 g
1 mg – 10 kg	21.111,11 g

Test weights class E2

Class E2 Milligram weights, flat polygonal sheet, aluminium / German silver

Test weight material: Aluminium 1 mg – 5 mg / German silver 10 mg – 500 mg
Container material: Lined plastic

Milligram weight			+	Container		+	DAkkS certificate		=		
KERN	Tol ±mg			**KERN**			**KERN**			**KERN**	
318-01	1 mg	0,006		347-009-400			962-351				
318-02	2 mg	0,006		347-009-400			962-352				
318-03	5 mg	0,006		347-009-400			962-353				
318-04	10 mg	0,008		347-009-400			962-354				
318-05	20 mg	0,010		347-009-400			962-355				
318-06	50 mg	0,012		347-009-400			962-356				
318-07	100 mg	0,016		347-009-400			962-357				
318-08	200 mg	0,020		347-009-400			962-358				
318-09	500 mg	0,025		347-009-400			962-359				

Class E2 Individual weights, compact shape, polished stainless steel

Test weight material: Polished stainless steel
Container material: Lined plastic

Individual weight			+	Container		+	DAkkS certificate		=		
KERN	Tol ±mg			**KERN**			**KERN**			**KERN**	
316-01	1 g	0,03		317-020-400			962-331				
316-02	2 g	0,04		317-020-400			962-332				
316-03	5 g	0,05		317-030-400			962-333				
316-04	10 g	0,06		317-040-400			962-334				
316-05	20 g	0,08		317-050-400			962-335				
316-06	50 g	0,10		317-060-400			962-336				
316-07	100 g	0,16		317-070-400			962-337				
316-08	200 g	0,3		317-080-400			962-338				
316-09	500 g	0,8		317-090-400			962-339				
316-11	1 kg	1,6		317-110-400			962-341				
316-12	2 kg	3,0		317-120-400			962-342				
316-13	5 kg	8,0		317-130-400			962-343				
316-14	10 kg	16,0		317-140-400			962-344				

Class E2 Individual weights, cylindrical shape, polished stainless steel

Test weight material: Polished stainless steel
Container material: Lined plastic or wooden box (317-150-100 and 317-160-100)

Individual weight			+	Container		+	DAkkS certificate		=		
KERN	Tol ±mg			**KERN**			**KERN**			**KERN**	
317-01	1 g	0,03		317-020-400			962-331				
317-02	2 g	0,04		317-020-400			962-332				
317-03	5 g	0,05		317-030-400			962-333				
317-04	10 g	0,06		317-040-400			962-334				
317-05	20 g	0,08		317-050-400			962-335				
317-06	50 g	0,10		317-060-400			962-336				
317-07	100 g	0,16		317-070-400			962-337				
317-08	200 g	0,3		317-080-400			962-338				
317-09	500 g	0,8		317-090-400			962-339				
317-11	1 kg	1,6		317-110-400			962-341				
317-12	2 kg	3,0		317-120-400			962-342				
317-13	5 kg	8,0		317-130-400			962-343				
317-14	10 kg	16,0		317-140-400			962-344				
317-15	20 kg	30,0		317-150-100			962-345				
317-16	50 kg	80,0		317-160-100			962-346				

For individual weights, wooden boxes are also available as an alternative to the plastic containers.
For more details on this, please see page 183.

For weights
≤ 500 g

For weights
≥ 1 kg

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Test weights accessories

Tweezers, gloves, dusting brush

Tweezers to be able to safely grip small test weights					
For class	**For weights**	**KERN**	**Length**		**Version**
E1 – F1	1 mg – 200 g	**315-243**	105 mm	1	Stainless steel with silicone-coated tips
E1 – F1	500 g – 2 kg	**315-245**	250 mm	1	Stainless steel with silicone-coated tips
F2 – M3	1 mg – 200 g	**335-240**	100 mm	2	Stainless steel
E1 – M1	1 mg – 200 g	**315-242**	100 mm	3	Plastic

Gloves cotton, 1 pair. Help to protect the test weights when being used daily, from grease from fingers, damp etc.	
KERN	
317-280	

Gloves leather / cotton, 1 pair. Help to protect the test weights when being used daily, from grease from fingers, damp etc.	
KERN	
317-290	

Dusting brush to clean the weights	
KERN	
318-270	

Boxes for individual weights / test weights

Box material: Lined wood
Suitable for individual weights
KERN-Nr. 307, 316, 317, 326, 327, 329

For weights ≤ 500 g

For weights ≥ 1 kg

Wooden box for individual weights E1 – F1		
For weight	**KERN**	
mg	**338-090-200**	
1 g	**317-010-100**	
2 g	**317-020-100**	
5 g	**317-030-100**	
10 g	**317-040-100**	
20 g	**317-050-100**	
50 g	**317-060-100**	
100 g	**317-070-100**	
200 g	**317-080-100**	
500 g	**317-090-100**	
1 kg	**317-110-100**	
2 kg	**317-120-100**	
5 kg	**317-130-100**	
10 kg	**317-140-100**	
20 kg	**317-150-100**	
50 kg	**317-160-100**	

Box material: Wood
Suitable for individual weights
KERN-Nr. 337, 347, 357, 367

For weights ≤ 500 g

For weights ≥ 1 kg

Wooden box for individual weights F2 – M3		
For weight	**KERN**	
mg	**338-090-200**	
1 g	**337-010-200**	
2 g	**337-020-200**	
5 g	**337-030-200**	
10 g	**337-040-200**	
20 g	**337-050-200**	
50 g	**337-060-200**	
100 g	**337-070-200**	
200 g	**337-080-200**	
500 g	**337-090-200**	
1 kg	**337-110-200**	
2 kg	**337-120-200**	
5 kg	**337-130-200**	
10 kg	**337-140-200**	
20 kg	**337-150-200**	
50 kg	**337-160-200**	

For weights ≥ 10 kg

Wooden box for check weights F2, M1		
For weight	**KERN**	
10 kg	**337-141-200**	
20 kg	**337-151-200**	
50 kg	**337-161-200**	

For weights ≥ 10 kg

Aluminium box for individual weights, cylindrical shape, class E1, E2, F1 and F2		
Largest possible weight	**KERN**	
10 kg	**317-140-600**	
20 kg	**317-150-600**	

Test weights accessories

Cases / boxes for individual weight sets

Individual weight sets:
You can create your own "tailor-made" individual weight sets yourself. KERN will customise your own personal wooden box / plastic carrying case. The largest individual weight which will fit is given in the table.

Sample order:
Your individual weight set:
1 x 50 g, 2 x 100 g, 1 x 500 g, 2 x 1 kg, 1 x 2 kg.

The correct individual box is **KERN-Nr. 313-080-400** (plastic) or **KERN-Nr. 315-070-100** (wood).

Plastic case
for individual weight sets classes E2 – M3, not appropriate for cast iron weights

KERN	Largest possible weight	
313-050-400	≤ 500 g	
313-080-400	≤ 5 kg	

Wooden box
for individual weight set classes F2 – M3

KERN	Largest possible weight	
335-040-200	≤ 200 g	
335-050-200	≤ 500 g	
335-060-200	≤ 1 kg	
335-070-200	≤ 2 kg	
335-080-200	≤ 5 kg	
335-090-200	≤ 10 kg	

Wooden box
for individual weight sets classes E1 – F1

KERN	Largest possible weight	
315-040-100	≤ 200 g	
315-060-100	≤ 1 kg	
315-070-100	≤ 2 kg	
315-080-100	≤ 5 kg	
315-090-100	≤ 10 kg	

## Plastic carrying case for standard weight sets

Aluminium case
for safe storage and transportation under harsh industrial conditions.

Plastic case for weight sets
with standard denomination classes E2 – M3, not appropriate for cast iron weights

KERN	Largest possible weight	
313-052-400	≤ 500 g	
313-082-400	≤ 5 kg	

Aluminium case
for weight sets with standard denomination classes E1, E2

KERN	Largest possible weight	
313-042-600	≤ 200 g	
313-062-600	≤ 1 kg	
313-082-600	≤ 5 kg	
313-090-600	≤ 10 kg	

Weight carriers for block weights or other test weights
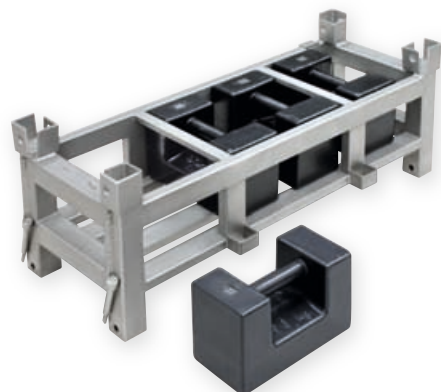
Individual weight carriers for testing high capacity floor scales, pallet scales, pallet truck scales, crane scales, etc. This can also be used for storing the weights.
This means the weight container and the weights can be placed on the scale in one go, saving time and money.

The weight container can be calibrated to OIML accuracy classes M1 – M3.

On request, KERN will make you a "tailor-made" weight carrier to your specifications.

WolfLabs

Pricing on any accessories shown can be found by keying the part number into the search box on our website.

The specifications listed in this brochure are subject to change by the manufacturer and therefore cannot be guaranteed to be correct.
If there are aspects of the specification that must be guaranteed, please provide these to our sales team so that details can be confirmed.

www.wolflabs.co.uk

Please contact us if this literature doesn't answer all your questions.