



sartorius
mechatronics

Mass Metrology Precision Is a Matter of Having the Right Equipment



turning science **into solutions**

Precision Beyond Compare

International trade requires standardized weights and measures worldwide. Mass plays an essential role here, as the major part of world trade is conducted on the basis of mass. To ensure that measurements of mass are made on the same basis throughout the world, each country has a National Metrology Institute (NMI) that compares and traces all units to guarantee their consistent accuracy. These National Metrology Institutes (NMIs) represent the authority in all matters relating to physical units of measure and national standards – they are the “measure of all things.”

For and in cooperation with NMIs and the BIPM, Sartorius, a global expert in metrology, develops innovative mass comparators of the very highest quality alongside other groundbreaking products and systems.

In the last years alone, the following products have been introduced in cooperation with metrology institutes:

- A variety of robot systems
- Fully automatic systems for determining the volume of weights
- 1 kg prototype mass comparator with an incredibly high resolution of 0.0000001 g
- And many more products at the forefront of technology

At this point, we would like to specially thank all our partners for their outstanding cooperation in helping to make our developments exceptionally successful.

For instance, together with the four partners listed below, we developed the most accurate balance in the world, the CCL1007 mass comparator:

- The Bureau International de Poids et Mesures (BIPM)
- The German Physikalisch-Technische Bundesanstalt (PTB)
- SIOS Messtechnik GmbH
- The Technical University of Ilmenau (TUI), Germany

With the support of the next two partners in Austria, we developed a number of robot systems and an innovative and fully automatic system for density determination:

- The Austrian Bundesamt für Eich- und Vermessungswesen (BEV, The Federal Office of Metrology and Surveying)
- The Technical University of Vienna

In cooperation with our two partners below, we developed a robot system along with sophisticated metrological software:

- Häfner Gewichte GmbH
- MARO Electronics



Products for the Determination of Mass

	Page
Automatic Mass Comparators and Robots	
Determination of Mass to the Very Highest Standards	4
From the 1 kg Prototype to Mass Standards	5
Robot for Fully Automated Determination of Mass from 1 mg to 1 kg	6
Automatic Mass Comparators with Load Alternator	8
Manual Mass Comparators	
Up to 1 kg	10
Up to 20 kg	11
Up to 300 kg	12
Up to 3000 kg	13
Summary and Product Recommendations	
Application Range of Mass Comparators in Accordance with OIML R111	14
Application Range of Mass Comparators in Accordance with ASTM E617	15
Selection of Comparators for Equipping a Mass Laboratory	16
Accessories	
Susceptometer – A Complete Solution for Testing the Magnetic Properties of Weights	17
Volume and Density Determination up to 1 kg	18
Density Determination up to 50 kg using the YP50K Pycnometer	19
Software for Mass Metrology – One Software	
Program for All Equipment ScalesNet32	20
Software for the Comparison of Mass – YPR02C	21
Accessories for Mass Metrology	22
Technical Specifications	
1 kg Prototype Mass Comparator and Robot	24
Mass Comparators with Load Alternator	25
Mass Comparators up to 1 kg	26
Mass Comparators from 1 kg to 10 kg	27
Mass Comparators from 10 kg to 60 kg	28
Mass Comparators from 60 kg to 300 kg	29
Mass Comparators from 600 kg to 3000 kg	30
Determination of Volume, Density, Susceptibility and Magnetism	31

Automatic Mass Comparators and Robots Determination of Mass to the Very Highest Standards

Sartorius masters the core disciplines of weighing like no other and sets new standards in mass metrology. In cooperation with the Bureau International des Poids et Mesures* and the Institute for Process Measurement and Sensor Technology of the Technical University of Ilmenau, Sartorius has developed a mass comparator – the CCL1007 – that is capable of determining differences in mass to an accuracy of 0.1 µg for weights of 1 kg – even under high-vacuum conditions.

The mass comparator is protected from environmental effects by a pressure-stable aluminum chamber. In the vacuum chamber, measurements can be performed at high vacuum up to 10⁻⁶ mbar. Unlike conventional stainless steel vacuum bell jars, the aluminum chamber does not cause any magnetic reactions that would affect the weighing system.

Test objects and reference weights can be introduced easily and positioned precisely through the lower loading hatch by means of an automatic loading device, without the need to open the entire vacuum chamber. The load alternator can accommodate up to eight weights. The position of the weight on the load alternator is assigned at the operating terminal. The quantity and method of mass comparisons are also entered at this terminal.

After the weight has been transferred into the interior of the vacuum chamber, a three-point lifting mechanism picks up this weight. This lifting mechanism determines the center of mass of the weight fully automatically and centers the weight on the load alternator.

The unique three-point holder is capable of handling both cylindrical weights and silicon spheres efficiently.

The equipment thus meets all of the requirements for the new definition of the kilogram using a silicon sphere. The scientific tests necessary to determine the Avogadro constant can therefore be performed conveniently and precisely.

The weigh cell is located in the upper section of the vacuum chamber. The weighing pan for the substitution weights is accessed via the upper loading hatch.

The motors that drive the load alternator and the weight changing device are located outside the vacuum chamber. This reduces interference caused by temperature fluctuations.

The driving force of these motors is transferred into the interior of the vacuum chamber by rotary axes and vacuum couplings. The load alternator is driven by a pulley hoist system.

All components inside the vacuum chamber are completely resistant to high vacuum and, therefore, will not outgas under vacuum. This prevents any contamination of the weights. All materials used in the vacuum chamber are solid materials with a low vapor pressure. They are free of oil and grease and thus ideally suited to high-vacuum applications.

The more than 20 vacuum flanges enable additional sensors to be introduced into the vacuum chamber, which has sufficient space to accommodate additional measuring instruments.



The vacuum chamber of the CCL1007

* International Bureau of Weights and Measures (BIPM)

From the 1 kg Prototype to Mass Standards

Areas of Application

- Use as a 1 kg prototype weighing system for the subdivision of the mass of the primary reference standards of National Metrology Institutes (NMIs) with national mass reference standards (kilogram prototype)
- Dissemination of the mass scale of NMIs in the range of 1 kg to 1 mg; adapter plates are required for groups of weights and weights < 200 g
- Determination of mass for international comparison measurements (key comparisons) and calibrations for national institutes, calibration laboratories and industry in accordance with the attainable measurement uncertainties specified in the CMC tables published by the BIPM
- Experimental determination of air density by comparison weighing of special buoyancy artifacts in air and under vacuum
- Determination of the mass of 1 kg silicon spheres (also suitable within the scope of the Avogadro project for more accurate definition of the Avogadro constants and for new definition of the kilogram mass unit)
- Experimental research on the impact of cleaning procedures as well as on the effects that sorption and convection could have on mass and on the long-term stability of mass standards



The load alternator of the CCL1007

Technical Specifications	CCL1007
Maximum capacity	1031 g
Readability	0.1 µg
Repeatability, s*	s ≤ 0.2 µg
Repeatability in vacuum, s*	s ≤ 0.1 µg
Repeatability (typical), s*	s ≤ 0.1 µg
Linearity	≤ 1 µg
Electronic weighing range	2 g
Pressure range	10 ⁻⁶ – 1000 mbar
Application ranges:	
OIML – R111 classes	≤ E1 1 kg
with adapter plates for groups of weights	≤ E1 1 mg ...1 kg
Silicon sphere	95 mm Ø

s* The standard deviation "s" is the repeatability calculated from 6 ABBA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Robot for Fully Automated Determination of Mass from 1 mg to 50 kg



Comb-type weight grabber with 4 weights

Robot systems with latest weighing technology guarantee highest accuracy for the mass determination.

The fully automated mass comparison simplifies work in the mass laboratory. This enables complete sets of weights to be measured efficiently within the shortest time possible.

The comb-type weight grabbers are designed so that any desired types of weight – wire or leaf weights or knob, cylindrical or disk weights – can be handled efficiently.

The number of magazine positions is specified by the customer. Up to 164 magazine positions can be provided for the range of 1 mg to 1 kg.

The robot systems are supplied with a PC and user-friendly control software.

Naturally, all Sartorius robot systems can be controlled directly by ScalesNet 32 (see YSN01C on pages 20–21). This is a software program designed to cover all requirements and to network all equipment in the mass standards laboratory.



Close-up of the CCR10-1000 magazine

Reference and test weights are positioned in the magazine that accommodates a high number of weights. The weighing mode is entered on the PC, the number of comparison cycles is defined and a direct 1:1 mass comparison or subdivision (dissemination of mass for class E1 weights) is initiated. The robot retrieves the weights from the magazine and starts mass comparison. Prior to mass comparison, the robot automatically combines the groups of weights required for dissemination of mass according to the weighing design.

For **efficient operation** of the robot, the reference weight and test weight are placed on separate comb-type weight grabbers. These weight grabbers accommodate a group of up to four weights. Groups of weights are placed on the weighing pan simultaneously, guaranteeing fast loading of the mass comparator with reference and test weights.



Detail of the magazine for CCR10-1000

Technical Specifications CCR10 | CCR1000 | CCR10-1000

	CCR10	CCR1000	CCR10-1000
Application range (E1)	1 mg – 10 g	10 g – 1 kg	1 mg – 1 kg
Maximum capacity	10.5 g	1002 g	10.5 g 1002 g
Readability	0.1 µg	1 µg	0.1 µg 1 µg
Repeatability, s*	≤ 0.3 µg	0-100 g : ≤ 3 µg ≤ 8 µg	≤ 0.3 µg 0-100 g : ≤ 3 µg - ≤ 8 µg
Repeatability (typical), s*	≤ 0.2 µg	≤ 2 µg	≤ 0.2 µg ≤ 2 µg
Linearity	1 µg	20 µg	1 µg 20 µg
Electronic weighing range	3.5 g	2.1 g	3.5 g 2.1 g
Magazine positions	39	21	60
Optional magazine positions	26-65	2-39	2-104



Robot systems, CCR10-1000, for determining the mass of weights (1 mg – 1 kg)

s* The standard deviation "s" is the repeatability calculated from 6 ABBA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Automatic Mass Comparators with Load Alternator

Automated weight handling provides the best repeatability.

Sartorius mass comparators with a load alternator perform fully automatic mass comparison of individual reference mass standards and groups of weights in any combination. As no additional cylindrical or stackable weights are required, loss of accuracy is prevented.

Relatively large objects, such as disk weights, buoyancy artifacts and pressure disks, can also be easily positioned for determination of their mass.

To determine air density, we recommend our climate measurement station YCM02C|YCM03C (see page 22) and YCM05C along with the associated software.

The ScalesNet32 software enables all mass and volume comparators, automatic systems and climate measurement stations in a mass laboratory to be networked together. The software is designed for data acquisition, automatic equipment control, data evaluation and storage, and generation of calibration certificates. ScalesNet32 covers all international requirements placed on a professional mass laboratory (see pages 20–21).



Comparison of mass standards as groups of weights using the CCE1000S-L



Subdivision weighing on CCE1000S-L|CCE1000U-L|CCE2000S-L



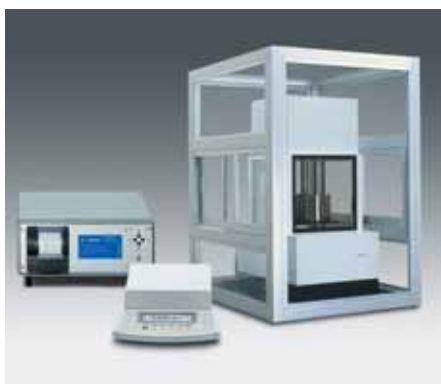
Comparison of a weight with a group of mass standards using the CCE50001S-L

Mass comparators with a load alternator are ideally suited for determining the mass of class E1 weights.

The generously sized weighing pan provides sufficient space for the calibration of groups of weights and large-diameter weights.

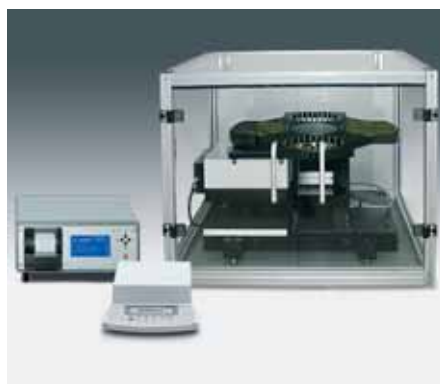
The integrated centering equipment is positioned below the weighing pan to give the user the best possible access.

These mass comparators can also be used as stand-alone instruments without a PC. Networking and PC control are possible by using external programs.



CCE1000S-L

Maximum capacity: 1.002 kg
 Electronic weighing range: 2 g
 Readability: 0.001 mg
 Repeatability (typical), s*: 0.001 mg



CCE10000U-L

Maximum capacity: 10.05 kg
 Electronic weighing range: 60 g
 Readability: 0.01 mg
 Repeatability (typical), s*: 0.02 mg



CCE50001S-L

Maximum capacity: 51 kg
 Electronic weighing range: 51 kg
 Readability: 1 mg
 Repeatability (typical), s*: 2 mg

CCE10000S-L

Maximum capacity: 10.05 kg
 Electronic weighing range: 60 g
 Readability: 0.1 mg
 Repeatability (typical), s*: 0.05 mg

CCE20000S-L

Maximum capacity: 20.05 kg
 Electronic weighing range: 60 g
 Readability: 0.1 mg
 Repeatability (typical), s*: 0.1 mg

s* The standard deviation "s" is the repeatability calculated from 6 ABBA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Manual Mass Comparators up to 1 kg

The new CCE generation of manually-operated weighing equipment is the ultimate in manual mass comparators.

With up to 61 million weighing steps, these instruments are world class. The monolithic weigh cells that are manufactured as a single structure from a high-quality aluminum alloy deliver results with outstanding repeatability.

Reliability and speed are key features of this new class of mass comparators.

All manual CCE comparators have a fully electronic weighing range or several overlapping weighing ranges. As a result, any weight value between 0 g and the maximum capacity can be attained.

The CCE products have an electronic draft shield and below-balance weighing equipment.

Below-balance weighing equipment in Sartorius mass comparators makes density determination easy. This equipment is standard on nearly all mass comparators in this product range.

In addition to the below-balance weighing equipment, Sartorius mass comparators are also available with the YDK01 density determination kit.



CCE6

Maximum capacity and electronic weighing range: 6.1 g
 Readability: 0.1 µg
 Repeatability (typical), s*: 0.2 µg



CCE36

Maximum capacity and electronic weighing range: 31 g
 Readability: 1 µg
 Repeatability (typical), s*: 1 µg



CCE66

Maximum capacity and electronic weighing range: 61 g
 Readability: 1 µg
 Repeatability (typical), s*: 1 µg



CCE111

Maximum capacity: 111 g
 Electronic weighing range: 21 g
 Readability: 1 µg
 Repeatability (typical), s*: 2 µg



CCE605

Maximum capacity: 610 g
 Electronic weighing range: 610 g
 Readability: 10 µg
 Repeatability (typical), s*: 15 µg



CCE1005

Maximum capacity: 1105 g
 Electronic weighing range: 610 g
 Readability: 10 µg
 Repeatability (typical), s*: 20 µg

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Manual Mass Comparators up to 20 kg

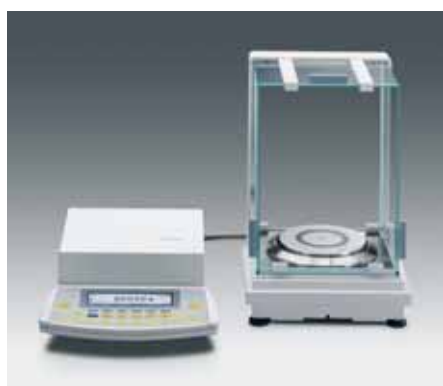
Developed for mass metrology, the integrated application software facilitates daily work routines. This software guides the user, while mass comparator takes over the timing and, at the end of the ABA or ABBA cycles, delivers the difference in mass, standard deviation and individual values.

All CCE mass comparators up to a load range of 5 kg have a built-in motorized calibration and adjustment weight.

The majority of Sartorius manual mass comparators are designed so that they do not require space-consuming centering equipment within the weighing chamber.

The complete electronics and the power supply for display and evaluation are separate from the weighing system in order to prevent heat from affecting the results.

Additional draft shields are available for nearly all models. They reduce air movement caused by air conditioning systems and, in this way, enable excellent repeatability to be achieved even under unfavorable ambient conditions (for a list, see page 23).



CCE1004

Maximum capacity and electronic weighing range: 1.2 kg
 Readability: 0.1 mg
 Repeatability (typical), s*: 0.05 mg

CCE2004

Maximum capacity and electronic weighing range: 2.5 kg
 Readability: 0.1 mg
 Repeatability (typical), s*: 0.1 mg

CCE5003

Maximum capacity and electronic weighing range: 5.1 kg
 Readability: 1 mg
 Repeatability (typical), s*: 0.5 mg

CCE5004

Maximum capacity and electronic weighing range: 5.1 kg
 Readability: 0.2 mg
 Repeatability (typical), s*: 0.3 mg



CCE10000S

Maximum capacity: 10.05 kg
 Electronic weighing range: 60 g
 Readability: 0.1 mg
 Repeatability (typical), s*: 0.1 mg

CCE20000

Maximum capacity: 20.05 kg
 Electronic weighing range: 60 g
 Readability: 1 mg
 Repeatability (typical), s*: 1 mg



CCE10K3

Maximum capacity and electronic weighing range: 11 kg
 Readability: 1 mg
 Repeatability (typical), s*: 1 mg

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

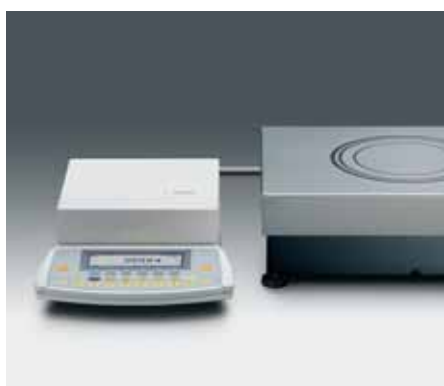
Manual Mass Comparators up to 300 kg

All mass comparators from a load range of 40 kg have a continuous, full-resolution weighing range and large weighing pan. This makes them ideal for universal use.

If necessary for below-balance weighing, a hanger can be attached directly to the port on the weigh cell. In this way, for example, a simple, yet highly accurate, density measurement setup can be achieved. The integrated software supplied for density determination on all CCE models simplifies work routines.

The single-point monolithic weigh cell based on electromagnetic force compensation supports over 60 kg. As a result of the direct introduction of force into the weigh cell, unprecedented repeatabilities of just a few milligrams are achieved with this weighing system. Due to the direct introduction of force, the off-center loading error (eccentricity) is extremely low, and the stated specifications are also achieved without the use of a Centermatic.

Depending on the ambient conditions, the excellent repeatabilities can be increased still further by using a Centermatic and a draft shield.



CCE40K3

Maximum capacity: 41 kg
 Readability: 2 mg
 Repeatability (typical), s*: 3 mg

CCE60K2

Maximum capacity: 64 kg
 Readability: 10 mg
 Repeatability (typical), s*: 7 mg

CCE60K3

Maximum capacity: 64 kg
 Readability: 2 mg
 Repeatability (typical), s*: 4 mg

CCI60K2

Maximum capacity: 64 kg
 Readability: 50 mg
 Repeatability (typical), s*: 100 mg

CCI100K2

Maximum capacity: 151 kg
 Readability: 50 mg
 Repeatability (typical), s*: 200 mg

CCI300K

Maximum capacity: 303 kg
 Readability: 1000 mg
 Repeatability (typical), s*: 500 mg

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

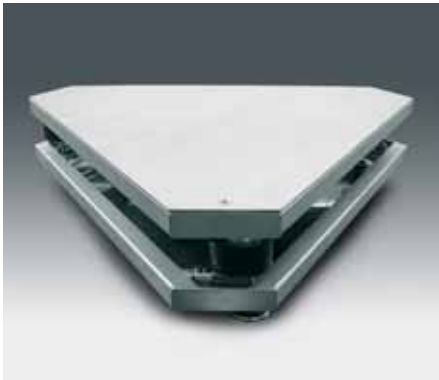
Manual Mass Comparators up to 3000 kg

All Sartorius heavy-duty mass comparators are made of high quality stainless steel. This design eliminates the possibility of magnetic reactions from magnetic weights having an effect on comparison weighing.

The unique sandwich construction with integrated, strain-free weigh cells guarantees excellent repeatabilities even when weights are loaded in a "heavy-handed" way.

Models of the CCS range are equipped with four high-resolution strain-gauge type load cells which are aligned with one other. Draft shields are available for all high-capacity mass comparators (see page 23).

The innovative sturdy three-point frame of the CCT models with three high-resolution strain-gauge type load cells guarantees a stable and distortion-free setup. Potential off-center loading errors are minimized due to the large distances between the weigh cells.



CCT1000K

Maximum capacity: 1200 kg
 Readability: 1 g
 Repeatability (typical), s*: 2 g
 Dimensions in cm,
 WxDxH: 151x131x30

CCT2000K

Maximum capacity: 2010 kg
 Readability: 1 g
 Repeatability (typical), s*: 5 g
 Dimension in cm,
 WxDxH: 192x166x30

CCS600K

Maximum capacity: 605 kg
 Readability: 1 g
 Repeatability (typical), s*: 2 g
 Dimensions in cm,
 WxDxH: 80x100x30

CCS1000K

Maximum capacity: 1510 kg
 Readability: 5 g
 Repeatability (typical), s*: 5 g
 Dimensions in cm,
 WxDxH: 80x100x30

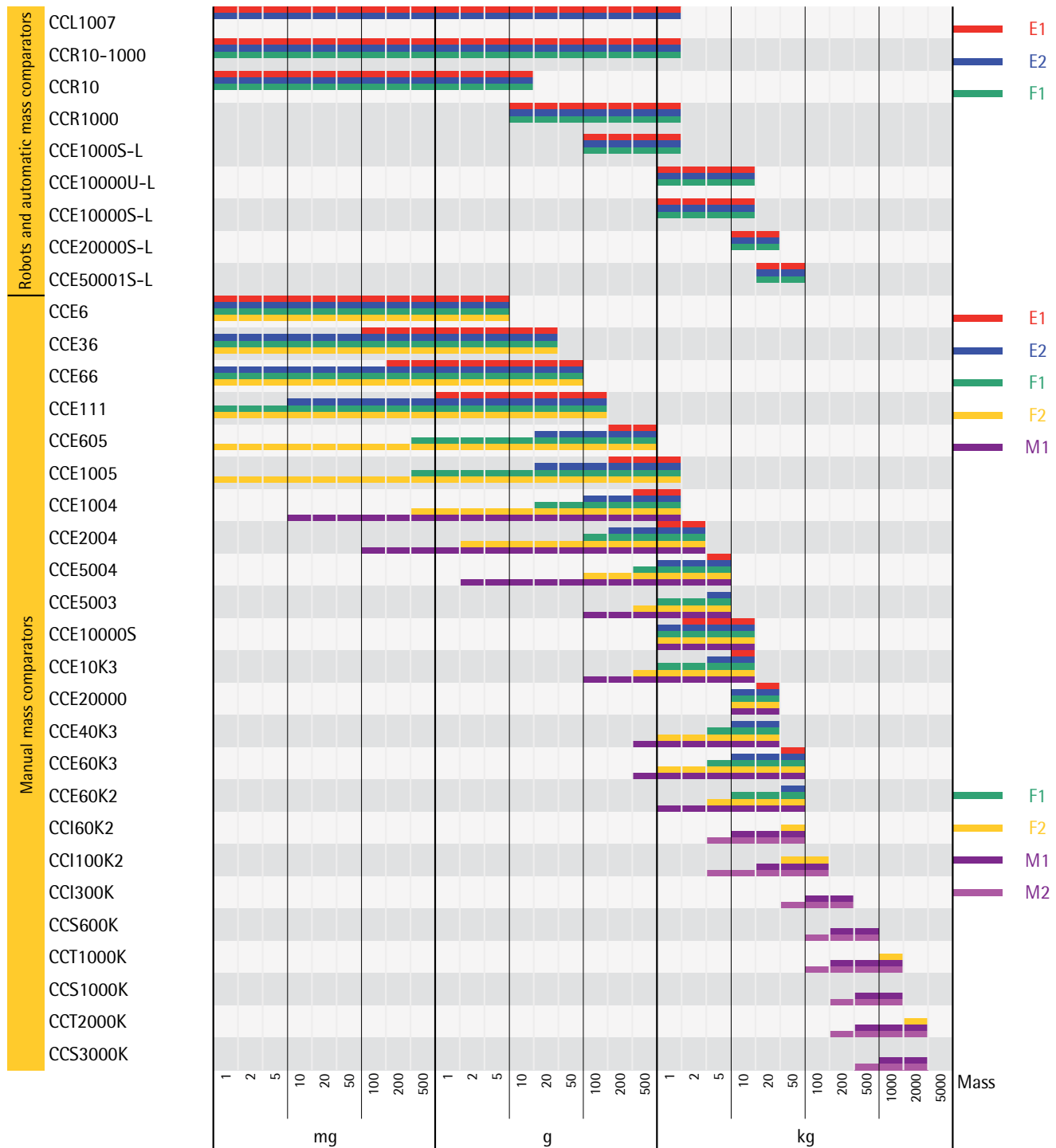
CCS3000K

Maximum capacity: 3010 kg
 Readability: 10 g
 Repeatability (typical), s*: 12 g
 Dimensions in cm,
 WxDxH: 150x125x30

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Summary and Product Recommendations

Application Range of Mass Comparators in Accordance with OIML R111



The chart shows the suitability of mass comparators for the OIML R111 accuracy classes.

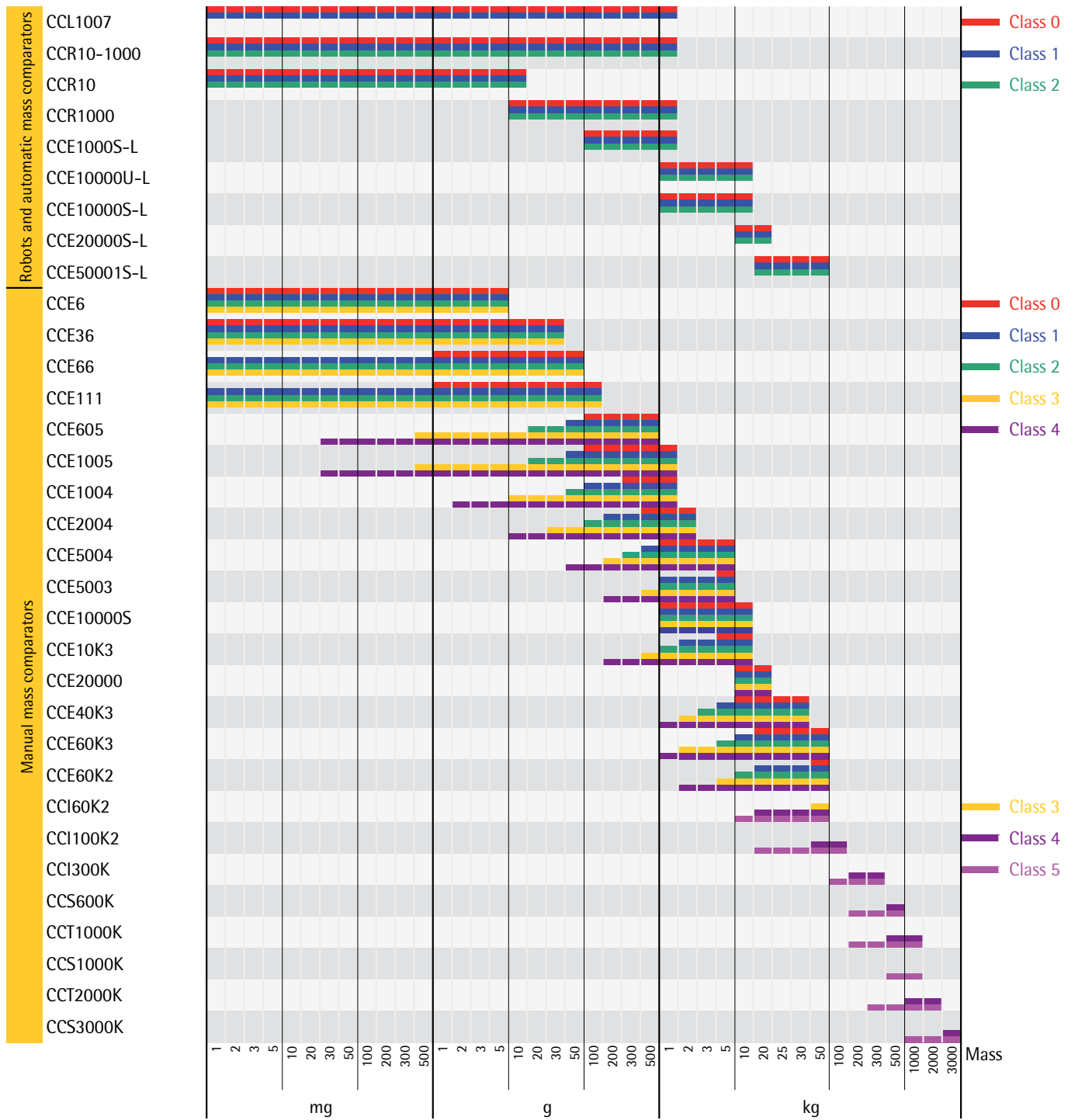
The results shown in the bar chart were obtained by performing at least 3 ABBA cycles with automatic comparators and 3 ABA cycles with manual comparators.

The diagram shows the suitability of comparators at a confidence level of 95% ($K=2$) for the application ranges.

The stated application ranges can be extended to include smaller weights by increasing the number of comparison measurements.

Automated mass comparators even noticeably exceed the stringent requirements for class E1 measurement uncertainty, which makes them suitable for use in national primary standard laboratories.

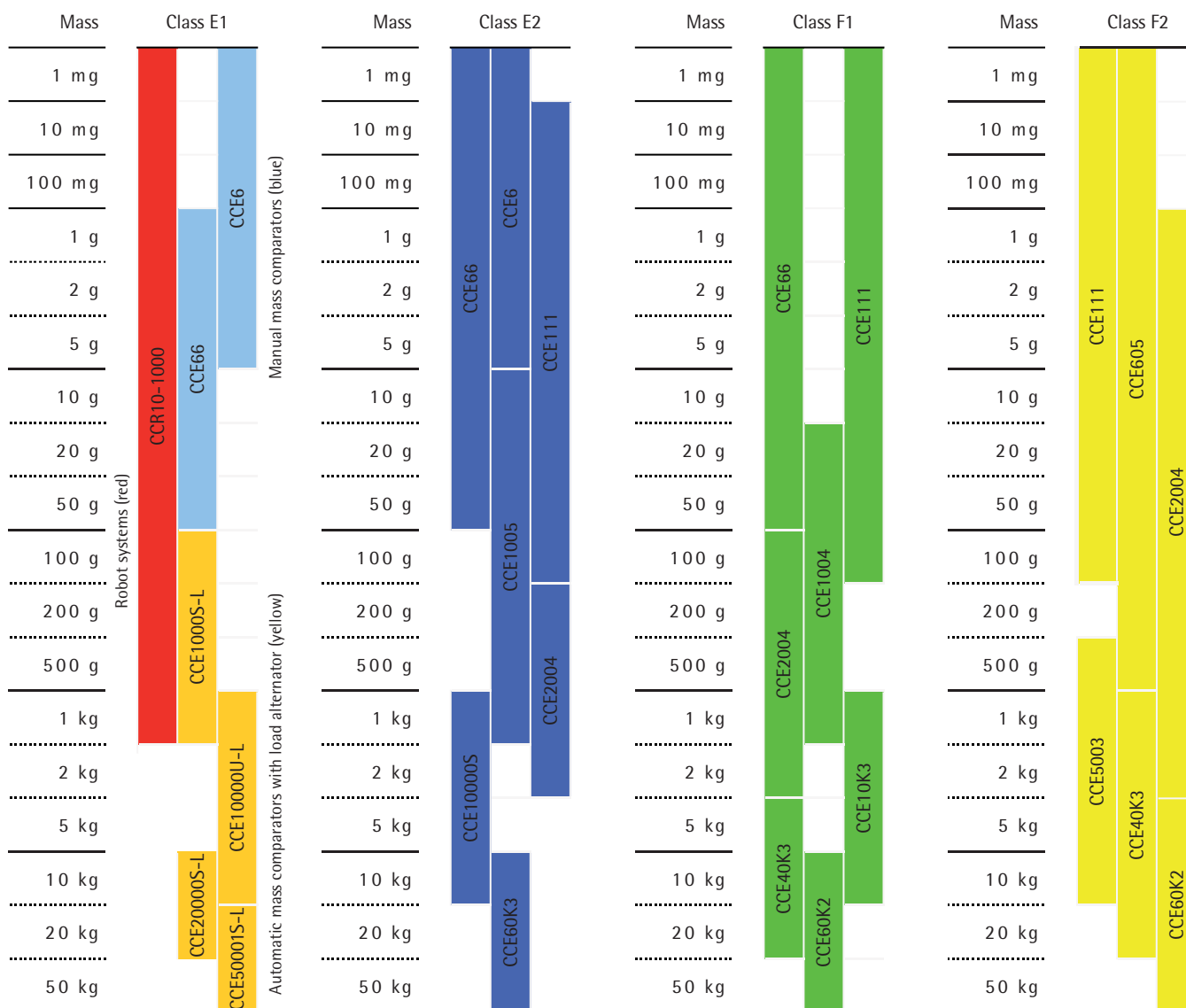
Application Range of Mass Comparators in Accordance with ASTM E617



The chart shows the suitability of mass comparators for the ASTM E617 accuracy classes.

The results shown in this bar chart are based on a confidence level of 95% (K=2) and the performance of at least 3 ABBA cycles on automatic comparators and 3 ABA cycles on manual comparators.

Selection of Comparators for Equipping a Mass Laboratory



The bar graph shows a selection of mass comparators that we recommend for the various areas of application.

This page shows just a few examples of mass comparators in our broad range.

Accessories

Susceptometer – A Complete Solution for Testing the Magnetic Properties of Weights

The OIML R111 stipulates that magnetic properties of weights be determined prior to mass calibration. This confirms that the requirements placed on weights no longer only apply to geometric quantities, material density, weight, or surface qualities. In fact, many scientific evaluations support the demand that both the susceptibility and magnetization of weights be considered.

Susceptometer Method

There are several methods for defining the magnetic properties of weights. The susceptometer method is stipulated in OIML R111 for testing weights of classes E1, E2, F1 and F2. The new YSZ01C | YSZ02C susceptometer from Sartorius lets you easily and conveniently determine the susceptibility and magnetization of weights in accordance with OIML R111.

The susceptometer method measures the interaction between a permanent magnet and the weight to be tested as a function of the force exerted on a mass standard. A high-resolution balance is used for this test. The desired magnetic properties of the weight can be calculated on the basis of the known properties of the test magnet, the distance of the weight from the test magnet and the weight's geometry.

The Sartorius susceptometer stands out against other well-known instruments by virtue of its highly compact design and integrated components. An innovative turning mechanism for adjusting the position of the test magnet and simple adjustment of the height of the loading platform also make working with the susceptometer simple and effective. This design significantly improves the repeatability of measurements. The susceptometer is available in two resolution levels. The YSZ01C features a 10- μg resolution; the YSZ02C has a 1- μg resolution.

Application Software

The software that comes standard with the susceptometer is exceptionally easy to use and enables data to be automatically transferred from the unit. It also supports the user through all required steps and provides assistance with settings before and during a measurement. Menu prompts request all relevant data and guide the user through the steps necessary for performing a measurement. The results of the test are recorded and can be exported to higher-level databases.

A User-friendly, All-in-one Solution

The YSZ01C | YSZ02C susceptometer from Sartorius rounds off the range of accessories for high-resolution balances and mass comparators. Along with its specialized software, the susceptometer provides a unique, complete solution that enables you to ensure that the limits of the magnetic properties of weights are maintained.



Susceptometer in a choice of versions YSZ01C, YSZ02C



Set of 3 reference magnets YSZ01RMC

Technical Specifications

Susceptometer	YSZ01C	YSZ02C
Readability of the susceptometer	10 μg	1 μg
Application range in accordance with OIMLR 111	E2 F1 F2	E1 E2 F1 F2
Dimensions	338 x 286	
Height	249 mm	
Maximum capacity	50 kg	
Dipole moment of the magnet	m ~ 0.1 Am ²	
Geometry ratio of the magnet	Height to diameter = 0.87	
Z ₀ , distance from center of magnet to the bottom of weight in mm	Adjustable in fixed steps: Z1 = 18 Z2 = 20 Z3 = 27 Z4 = 35 Z5 = 43	
Field strength due to different heights Z ₀ , in A/m	2700 2000 800 360 200	
Turning mechanism for magnet	Easy to operate by external rotary knob; marking for N-S orientation of the magnet	
Software	Convenient application software; standard settings and easy, user-defined configuration possible; quick check function; printing of reports, exporting of results	
Data transfer protocol	HTML mode and data transfer to user-specific metrology software via CSV file format	
YSZ01RMC	3 reference magnets in a wooden case for Sartorius susceptometer YSZ01C and YSZ02C	
YSZ01RSC	1 kg reference susceptibility standard in a wooden case for Sartorius susceptometer YSZ01C and YSZ02C with PTB magnetic susceptibility certificate	

Volume and Density Determination up to 1 kg

Density determination is often required in metrology and industry. The most accurate method for determining the density of solid objects in accordance with OIML R111 is hydrostatic mass comparison in liquid. In this procedure, a volume reference of known mass and volume is compared in liquid of known density with a test object of known mass. The volume or density of the test weights is calculated from the different buoyancies of the weights in the liquid.

Sartorius has integrated this OIML R111 method into a fully automatic volume comparator.

Sartorius offers two fully automatic systems for density determination for weights in the range from 1 g to 1 kg: models VD1005 and VL1005.

Both volume comparators have a nine-position load alternator in a liquid bath. Model VD1005 also has a second nine-position load alternator for substitution weights in air. The load alternator operates synchronously in that a position in air is assigned for each position in liquid. By using substitution weights, this innovative dual-weight alternator design makes it possible to directly compare the mass of a single-volume reference (e.g. silicon sphere) with a variety of weights in liquid.

Technical Specifications:

VD1005|VL1005

Density uncertainty*	1 kg/m ³
Volume uncertainty*	0.00015 cm ³
Weight diameter	6...100 mm
Maximum sphere diameter	95 mm

Application

Density determination of weights in accordance with OIML R111,

Class E1 1 g...1 kg

Comparator Technical Specifications

Maximum capacity	1125 g
Readability	0.01 mg
Repeatability, s*	≤ 40 µg
Repeatability (typical), s*	≤ 20 µg
Weighing range, electronic	350 g
Tare range (subtractive)	350 g

The load alternators and weighing pans are designed as comb-type weight grabbers so that weights and groups of weights from 1 g to 1 kg can be transferred directly from the load alternator to the suspended weighing pan. Adapter plates are not required. This has a positive effect on the accuracy of the overall measurement system.

After the data has been entered, a built-in PC with user-friendly software takes over fully automatic control of the volume comparator and evaluation of density measurement.



VD1005|VL1005, Volume comparator



The dual-weight alternator on model VD1005

* Partial uncertainty of the volume comparator (without references and test weights)

s* The standard deviation "s" is the repeatability calculated from 6 ABBA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Accessories for Density Determination

YVT01C	Thermostat
YWT20C	Table for VD1005 and VL1005
YDR1000SIC	1 kg silicon sphere with PTB density certificate
YCS31-612-09	Set of 1g to 1kg weights with PTB density certificate
YCS51-612-02	Set of E2 substitution weights with E1 DKD certificate



1 kg silicon sphere, YDR1000SIC

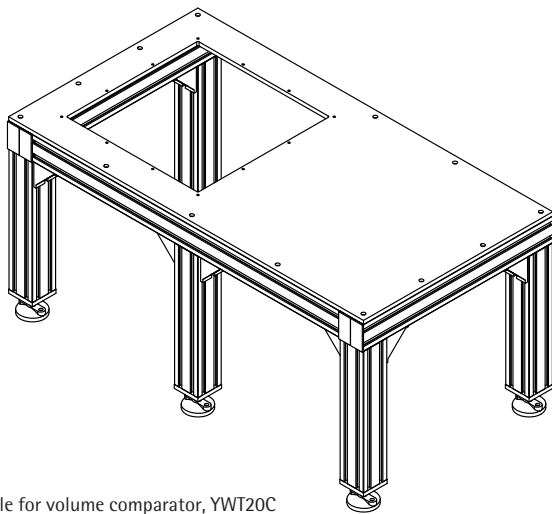


Table for volume comparator, YWT20C



Thermostat, YVT01C

Density Determination up to 50 kg Using the YP50K Pycnometer

Sartorius offers the YP50K pycnometer for determining the volume of weights in the range from 2 kg to 50 kg.

In combination with the CCE60K3 and a PC, the pycnometer is a reliable solution for determination of volume.

All required accessories, including a sturdy storage and shipping case, are included as standard equipment. A PC, mass comparator and reference weights are not included in the standard equipment supplied.

Software supports the user in volume determination.



Sartorius pycnometer, YP50K

Software for Mass Metrology – One Software Program for All Equipment ScalesNet32

Careful acquisition of weighing data and associated parameters is one of the most important criteria in mass metrology. To ensure that ScalesNet32 meets this requirement, it was continuously tested throughout the entire development phase in the DKD laboratory for correct functionality and suitability in practical daily use. These accompanying checks were carried out in an accredited DKD laboratory and are not only substantially responsible for the high degree of functionality achieved, but also provide the user with the necessary peace of mind. ScalesNet32 meets the requirements of all quality management systems that use calibrated weights to supply evidence of traceability to national standards.

The calibration of a weight is always allocated to an order or customer, the serial number, manufacturer, shape and features of the weight. These details are assigned to the test object and thus guarantee clear identification. The weight data is stored in a database; therefore, the history of the weight can be viewed at any time.

The mass comparators used to calibrate weights are monitored by ScalesNet32 and calibrated and adjusted at specified intervals. The calibration results obtained are stored in the database.

ScalesNet32 also monitors the mass standard and climate stations used, along with their associated sensors. The software informs the user of the calibrations that are due. The reference weight standards, climate stations and mass comparators are blocked from use once the tolerance interval has expired. The test intervals for the mass comparators, reference weights and climate equipment are set by the user in accordance with the particular requirements.

The following functions are available to the user:

- Calibration of customer weights
- On-location calibration of customer weights
- Calibration of reference weights
- Subdivision of weights
- Quick comparison of weights without printed report
- Calibration of weights with raw data output
- Manual input of weighing data for comparators without RS-232 connectivity
- Calibration of mass comparators, balances and scales
- Adjustment of mass comparators, balances and scales
- Recording and graphic plotting of external parameters

The principal features of ScalesNet32:

- Central SQL database for storing all measurement values and acquired information
- Automatic loading of weighing data over the RS-232 interface of the weighing instrument. The parameters of the interface can be generated in accordance with the weighing instrument manufacturer's data.
- Automatic detection of parameters defining ambient conditions during weighing cycles
- Number of weighing cycles and type of weighing procedure (ABA or ABBA) can be configured by class
- Selection of classes in accordance with OIML R111, ASTM 617 or other national standards
- Simultaneous testing of weights from a particular weight set on multiple mass comparators in the laboratory
- Plausibility testing after the reference weight set and weighing instrument have been selected (i.e., "Are both the instrument and the reference suitable for this class?")
- Test records generated for each weight tested; records include all data acquired during testing (reference weight, weighing instrument used, temperature, humidity, air pressure, etc.)
- The history of each weight tested can be viewed
- User-configurable certificates of verification, inspection, calibration or DKD calibration as Word templates; the data and test results are positioned in the Word template with bookmarks, which are replaced by measured values or other data when the report is printed; bilingual DKD certificates can be generated.
- Automatic generation of inventory lists of the weighing instruments and reference weights used
- Monitoring of calibration intervals for the mass comparators, reference weight sets and climate stations used

ScalesNet32, YSN01C

Components of ScalesNet32

ScalesNet32-Desk

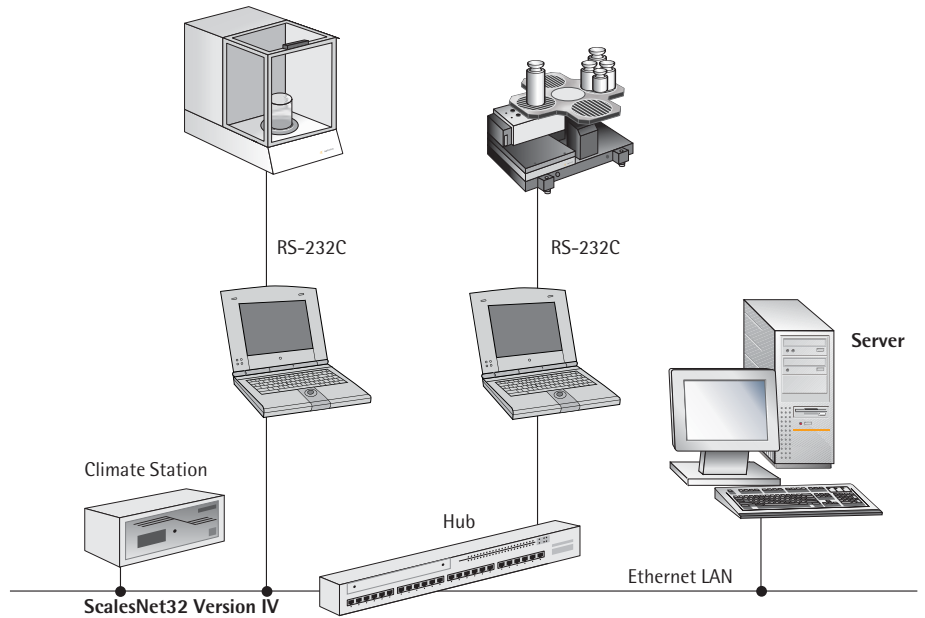
Module for the administration of all master data and orders, including all printouts. Connectivity to the ScalesNet32 database server is provided via Ethernet.

ScalesNet32-Mass

This module is designed for handling the calibration of test objects and mass standards as well as calibration and adjustment of comparators. Connectivity to the ScalesNet32 database server is provided via Ethernet or WLAN.

Climate Station (optional)

Collects the environment data of the weighing laboratory. The environment parameters are called up during a measurement cycle and combined with the weighing data. If a climate system that is not compatible with the system is used, a datalogger and converter combination is required to convert climate data into a format that ScalesNet32 can read.



Software for Mass Comparison - YPR02C

This application software is designed for highly accurate online determination of mass using Sartorius manual mass comparators and for controlling automatic comparisons of mass in conjunction with Sartorius automatic mass comparators. It runs on Microsoft Windows 2000 or XP.

The software facilitates the determination of the difference between two masses and the determination of absolute or apparent mass (conventional mass value), taking buoyancy errors into account. The program automatically implements buoyancy corrections after manual entry of the climate data or automatic acquisition of climate data using the climate station YCM02C or YSM03C. The climate data will be collected and stored on the PC.

The time at which the mass comparison takes place and the maximum uncertainty for automatic mass comparison are selectable.

The standard software contains a database for reference and test weights, and facilitates online calculation of the standard deviation and mass difference and the uncertainties at either the sigma 1, sigma 2 or sigma 3 level.

The number of ABBA or ABA cycles can be selected in the range from 01–99.



Software, YPR02C

Accessories for Mass Metrology

Mass Standards and Weights

Sartorius offers weights and mass standards in conformance with OIML R 111 in all accuracy classes ranging from E1 to M2 and from 1 mg to 1000 kg. M class mass standards are available up to 1000 kg in a variety of shapes, sizes and materials.

Class E1 and E2 sets are available in various weight combinations.

All weights are available individually, with or without DKD or PTB certification.

Please consult our separate brochure for details or visit our website at www.sartorius.com.



Set of weights, YSC011-611-00

A Sampling of Our Range of Weights Offered

Nominal Value	Order No.	Order No.	Order No.
	E1	DKD-calibrated E1	DKD-calibrated E2
1 mg – 5 g	YCS011-351-00	YCS011-351-02	YCS011-352-00
1 mg – 100 g	YCS011-511-00	YCS011-511-02	YCS011-512-00
1 mg – 200 g	YCS011-521-00	YCS011-521-02	YCS011-522-00
1 mg – 1 kg	YCS011-611-00	YCS011-611-02	YCS011-612-00
1 mg – 5 kg	YCS011-651-00	YCS011-651-02	YCS011-652-00
1 g – 1 kg	YCS31-611-00	YCS31-611-02	YCS31-612-00
1 g – 5 kg	YCS31-651-00	YCS31-651-02	YCS31-652-00
1 g – 10 kg	YCS31-711-00	YCS31-711-02	YCS31-712-00

Convenient Lifting Devices

Weight forks for 500 g	YAW41
Weight forks for 1 kg	YAW42
Weight forks for 2 kg	YAW43
Weight forks for 5 kg	YAW50
Handle for lifting weights – for 10 kg	YAW51
Handle for lifting weights – for 20 kg	YAW52
Handle for lifting weights – 50 kg	YAW53
Crane with chain hoist	YLD01C
Gripper for weights with handle	YLD02C

This climate measurement station with continuous, simultaneous recording of air pressure, room temperature and relative humidity is available in three versions: YCM02C | YCM03C and YCM05C.

YCM02C and **YCM05C** deliver the greatest accuracy and are preferred by national primary standard laboratories that calibrate with OIML-compliant class E1 weights.

The YCM02C climate measurement station consists of a psychrometer for temperature and humidity, a precision barometer and front display with keypad.

Up to nine additional temperature sensors can be attached. YCM05C consists of 6 temperature sensors, one air pressure sensor and one humidity sensor.

The **YCM03C** climate measurement station is a cost-effective alternative for calibration laboratories and legal verification authorities that calibrate class F weights in compliance with OIML E2.

The YCM03C climate measurement station contains a precision barometer combined with a temperature and humidity sensor. Up to nine additional temperature sensors or combined temperature | humidity sensors can be connected.



Climate measurement station, YCM02C

	Order No.
Weighing Tables	
Weighing table made of cast stone (L × W × H) 900 × 600 × 760 mm	YWT03
Weighing table (W × D × H) 900 x 750 x 750 with cast stone slab (W × D) 600 x 500	YWT09
Draft Shields	
for CC6, SE2, ME5, SC2, CCE6	YDS20C
for CCE1004, CCE2004, CCE5004, CCE5003	YDS24C
for CCE36, CCE66, CCE605, CCE1005, ME235S	YDS26C
for CCE1000S-L	YDS44C
for CCI60K2	YDS62C
for CCI100K2 CCI300K	YDS64C
for CCS600K CCS1000K	YDS80C
for CCT1000K	YDS85C
for CCT2000K	YDS87C
for CCS3000K	YDS82C
for CCE40K3, CCE60K3, CCE60K2	YDS03C
for CCE40K3, CCE60K3, CCE60K2, CCE10K3	YDS05C
Density Standards	
1000 g silicon sphere	YDR1000SIC
500 g silicon sphere	YDR500SIC
200 g silicon sphere	YDR200SIC
1000 g Zerodur sphere	YDR1000C
500 g Zerodur sphere	YDR500C
200 g Zerodur sphere	YDR200C
Set of weights from 1g to 1kg with PTB density certificate	YCS31-612-09
Special Weighing Pans	
Weighing pan with set of weighing plates for weighing mass combinations for CC1000S-L	YWP04C
Centering pan for CC30002 CC50002 and CCE40K3, CCE60K3 CCE60K2	YWP03C
Printers	
Data printer, with real-time clock for printing out date and time, and for statistical evaluation of weight values	YDP20-OCE
Switches	
Foot switch with T-connector	YFS01
Hand switch with T-connector	YHS02
Density Determination	
Hook for below-balance weighing for CC30002 CC50002 and CCE40K3, CCE60K3 CCE60K2	69EA0040
Density kit for CCE36, CCE66, CC111, CC500	YDK01LP



1 kg silicon sphere, YDR1000SIC



Mass comparators, CCE5004 + draft shield, YDS24C

Technical Specifications: 1 kg Prototype Mass Comparator and Robot



	CCL1007	CCR10	CCR1000
Maximum capacity	1031 g	10.5 g	1002 g
Application range	1 mg...1 kg	1 mg...10 g	10 g...1 kg
Readability	0.1 µg	0.1 µg	1 µg
Repeatability, s*	≤ 0.2 µg	≤ 0.3 µg	0-100 g : ≤ 3 µg ≤ 8 µg
Repeatability (typical), s*	≤ 0.1 µg	≤ 0.2 µg	≤ 2 µg
Electronic weighing taring range	2 g	3.5 g	2 g
Magazine positions	8	39	21
Optional magazine positions	-	26-65	2-39
Substitution weights	External	2×3.5 g	30 40 50 100 100 300 400 g
Linearity	1 µg	1 µg	20 µg
Range sensitivity	0.2 µg/500 mg	0.1 µg/10 mg	2 µg/500 mg
Stabilization time in s	60	15	25
Cycle time ABBA in s	480	240	240
Calibration weight optional	1 g Built-in	2 g E2 YCW322-00	2 g E2 YCW322-00
Standard Accessories			
Interfaces	LAN USB RS-232	LAN USB RS-232	LAN USB RS-232
Centermatic	Yes	No	Yes
Draft shield	Vacuum chamber	Yes, 2×	Yes, 2×
PC Software	Yes Yes	Yes Yes	Yes Yes
Optional Accessories			
Climate station	Climate station for an E1 lab.: YCM02C; climate station for an E2 lab.: YCM03C		
Software for PC	ScalesNet32, metrological control and evaluation software with database, YSN01C		
Miscellaneous	Vacuum pump		
Dimensions			
Weighing pan	3-point	52×24 mm	104×68 mm
Sample size (D×H)	34-95×100 mm	18×20 mm	100×120 mm
(W×D×H) in mm	940×840×1100	1800×1150×1800	1800×1150×1800

s* The standard deviation "s" is the repeatability calculated from 6 ABBA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Technical Specifications: Mass Comparators with Load Alternator



		CCE1000S-L	CCE10000U-L	CCE10000S-L	CCE20000S-L	CCE50001S-L
Maximum capacity	kg	1.002	10.05	10.05	20.05	51
Application range		100 200 300 500 600 1000g	1 2 3 5 6 10 kg	1 2 3 5 6 10 kg	10 20 kg	0...51 kg
Readability	mg	0.001	0.01	0.1	0.1	1
Repeatability, s*	mg	≤ 0.002	≤ 0.05	≤ 0.1	≤ 0.3	≤ 3
Repeatability (typical), s*	mg	≤ 0.001	≤ 0.02	≤ 0.05	≤ 0.1	≤ 2
Electronic weighing taring range	g	2	60	60	60	51000
Load alternator	pos.	4	4	4	4	2
Linearity	mg/g	0.02/0.5	0.3/50	0.3/50	3/50	50/50
Range sensitivity	mg/g	0.001/0.01	0.03/1	0.1/1	0.2/1	5/50
Stabilization time	s	25	20	10	10	10
Cycle time ABBA	s	240	240	240	240	720

Standard Accessories

Interfaces	RS-232C	RS-232C	RS-232C	RS-232C	RS-232C
Centermatic	Built-in	Built-in	Built-in	Built-in	Built-in
Draft shield	Integrated	Integrated	Integrated	Integrated	Integrated
Control unit	Integrated	Integrated	Integrated	Integrated	Integrated
Printer	Integrated	Integrated	Integrated	Integrated	Integrated

Optional Accessories

Climate station	YCM05C	YCM05C	YCM05C	YCM05C	YCM05C
Software for PC	YSN01C	YSN01C	YSN01C	YSN01C	YSN01C
Draft shield	YDS44C	-	-	-	-
Calibration weight	2 g E2 YCW322-00	50 g E2 YCW452-00	50 g E2 YCW452-00	50 g E2 YCW452-00	50 kg E2 YCW752-00

Dimensions

Weighing pan Ø	mm	9	200	200	200	70
Sample size (D×H)	mm	70×130	320×300	320×300	320×300	320×300
Weigh cell (W×D×H)	mm	230×365×510	790×720×430	790×720×430	790×720×430	1500×670×915
Display (W×D×H)	mm	360×310×150	360×310×150	360×310×150	360×310×150	360×310×150

s* The standard deviation "s" is the repeatability calculated from 6 ABBA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Technical Specifications: Mass Comparators up to 1 kg



		CCE6	CCE36 CCE66	CCE111	CCE605	CCE1005
Maximum capacity	g	6.1	31 61	111	610	1105
Application range	g	0...6	0...30 0...60	0...100	0...500	0...1105
Readability	mg	0.0001	0.001	0.001	0.01	0.01
Repeatability, s*	µg	0–2 g: ≤ 2 ≤ 0.3	0–2 g: ≤ 1 ≤ 2 ≤ 3	0–2 g: ≤ 1 ≤ 3	0–10 g: ≤ 10 ≤ 20	0–50 g: ≤ 15 ≤ 20
Repeatability (typical), s* µg		≤ 0.15	≤ 1	≤ 1	≤ 10	≤ 10
Electronic weighing taring range	g	6.1	31 61	26	610	610
Substitution weights	g	–	–	50 20 10	200 100	500
Linearity	µg	1	6 10	10	100	100
Range sensitivity	µg/mg	0.2/5	2/10	2/10	10/1000	10/2000
Stabilization time	s	10	15	15	10	15

Standard Accessories

Interfaces		2×RS-232C	2×RS-232C	2×RS-232C	2×RS-232C	2×RS-232C
isoCAL**		Integrated	Integrated	Integrated	Integrated	Integrated
Below-balance weighing		Included	Included	Included	Included	Included
Centermatic		–	–	–	–	–
Draft shield		Electric	Electric	Integrated	Integrated	Electric
Application Software		Built-in	Built-in	Integrated	Integrated	Built-in

Optional Accessories

Climate station		YCM05C	YCM05C	YCM05C	YCM05C	YCM05C
Software for PC		YSN01C	YSN01C	YSN01C	YSN01C	YSN01C
Draft shield		YDS20C	YDS26C	YDS22C	YDS22C	YDS26C
Calibration weight		5 g E2 YCW352-00	20 g E2 50 g E2 YCW422-00 YCW452-00	20 g E2 YCW422-00	200 g E2 YCW522-00	500 g E2 YCW552-00

Dimensions

Weighing pan Ø	mm	16	30	50	90	90
Sample size (D×H)	mm	16×70	30×120	50×120	135×140	90×200
Weigh cell (W×D×H)	mm	122×315×122	222×439×302	219×408×318	219×408×318	222×439×302
Display (W×D×H)	mm	254×320×106	254×320×106	213×307×107	213×307×107	254×320×106

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are a good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

** isoCAL fully automatic internal calibration and adjustment

Technical Specifications: Mass Comparators from 1 kg to 10 kg



		CCE1004	CCE2004	CCE5004	CCE5003	CCE10K3
Maximum capacity	g	1200	2500	5100	5100	10100
Application range	g	0...1200	0...2500	0...5100	0...5100	0...10000
Readability	mg	0.1	0.1	0.2	1	1
Repeatability, s*	mg	≤ 0.1	≤ 0.2	0–1 kg : ≤ 0.3 ≤ 0.5	≤ 1	≤ 2
Repeatability (typical), s* mg		≤ 0.05	≤ 0.1	≤ 0.3	≤ 0.5	≤ 1
Electronic weighing taring range	g	1200	2500	5100	5100	10100
Linearity	mg	1	1	3	5	50
Range sensitivity	mg/g	0.1/2	0.1/2	0.5/10	1/10	2/10
Stabilization time	s	10	10	10	10	10
Standard Accessories						
Interfaces		2×RS-232C	2×RS-232C	2×RS-232C	2×RS-232C	2×RS-232C
isoCAL**		Integrated	Integrated	Integrated	Integrated	-
Below-balance weighing		Included	Included	Included	Included	69EA0040 hook
Centermatic		-	-	-	-	-
Draft shield		Built-in	Built-in	Built-in	Built-in	-
Application Software		Built-in	Built-in	Built-in	Built-in	Built-in
Optional Accessories						
Climate station		YCM05C	YCM05C	YCM05C	YCM05C	YCM05C
Software for PC		YSN01C	YSN01C	YSN01C	YSN01C	YSN01C
Draft shield		YDS24C	YDS24C	YDS24C	YDS24C	YDS05C
Calibration weight		1 kg E2 YCW612-00	2 kg E2 YCW622-00	5 kg E2 YCW652-00	5 kg E2 YCW652-00	10 kg E2 YCW712-00
Dimensions						
Weighing pan	mm	∅ 130	∅ 130	∅ 130	∅ 130	350×240
Sample size (D×H)	mm	130×200	130×200	130×200	130×200	200×300
Weigh cell (W×D×H)	mm	240×260×355	240×260×355	240×260×355	240×260×355	350×240×133
Display (W×D×H)	mm	254×320×106	254×320×106	254×320×106	254×320×106	254×320×106

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

** isoCAL fully automatic internal calibration and adjustment

Technical Specifications: Mass Comparators from 10 kg to 60 kg



		CCE10000S	CCE20000	CCE40K3	CCE60K3 CCE60K2
Maximum capacity	kg	10.05	20.05	41	64
Application range	kg	1 2 3 5 6 10	10 20	0..41	0..64
Readability	mg	0.1	1	2	2 10
Repeatability, s*	mg	≤ 0.25	≤ 2.5	≤ 5	0–10 kg : ≤ 4 ≤ 10 ≤ 7 ≤ 10
Repeatability (typical), s*	mg	≤ 0.1	≤ 1	≤ 3	≤ 4 ≤ 7
Electronic weighing taring range	g	60	60	41000	64000
Substitution weights		–	10 kg	–	–
Linearity	mg	0.3	3	50	70
Range sensitivity	mg/g	0.1/1	1/1	10/100	20/100
Stabilization time	s	10	5	10	10

Standard Accessories

Interfaces		2×RS-232C	2×RS-232C	2×RS-232C	2×RS-232C
Below-balance weighing		–	–	69EA0040 hook	69EA0040 hook
Centermatic		Built-in	Built-in	–	–
Draft shield		Built-in	Built-in	–	–
Application Software		–	–	Built-in	Built-in

Optional Accessories

Climate station		YCM05C	YCM05C	YCM05C	YCM05C
Software for PC		YSN01C	YSN01C	YSN01C	YSN01C
Draft shield		–	–	YDS05C	YDS05C
Calibration weight		50 g E2 YCW452-00	50 g E2 YCW452-00	10 kg E2 YCW712-00	20 kg E2 YCW722-00

Dimensions

Weighing pan	mm	∅ 200	∅ 200	400×300	400×300
Sample size (D×H)	mm	200×300	200×300	400×300	400×300
Weigh cell (W×D×H)	mm	230×365×470	230×365×470	400×300×120	400×300×120
Display (W×D×H)	mm	213×307×107	213×307×107	254×320×106	254×320×106

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Technical Specifications: Mass Comparators from 60 kg to 300 kg



		CCI60K2	CCI100K2	CCI300K
Maximum capacity	kg	64	151	303
Application range	kg	0..64	0..151	0..303
Readability	g	0.05	0.05	1
Repeatability, s*	g	≤ 0.15	≤ 0.3	≤ 1
Repeatability (typical), s*	g	≤ 0.1	≤ 0.2	≤ 0.5
Electronic weighing taring range	kg	64	151	303
Linearity	g	2.4	4	8
Range sensitivity	g/kg	0.3/1	0.3/1	2/1
Stabilization time	s	10	10	10
Standard Accessories				
Interfaces		RS-232C RS-485	RS-232C RS-485	RS-232C RS-485
Application Software		-	-	-
Optional Accessories				
Centermatic		YWP03C	-	-
Climate station		YCM05C	YCM05C	YCM05C
Software for PC		YSN01C	YSN01C	YSN01C
Draft shield		YDS62C	Integrated	YDS64C
Calibration weight		20 kg F1 YCW723-00	50 kg F1 YCW753-00	2×50 kg F1 YCW753-00
Dimensions				
Weighing pan (side) or (W×D)	mm	560×450	800×600	800×600
Display (W×D×H)	mm	337×225×151	337×225×151	337×225×151

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Technical Specifications: Mass Comparators from 600 kg to 3000 kg



CCS600K

CCT1000K

CCS1000K

CCT2000K

CCS3000K

Maximum capacity	kg	605	1200	1510	2010	3010
Application range	kg	0...605	0...1200	0...1510	0...2010	0...3010
Readability	g	1	1	5	1	10
Repeatability s*	g	≤ 2,5	≤ 3	≤ 6	≤ 8	≤ 12
Repeatability (typical), s*	g	≤ 2	≤ 2	≤ 5	≤ 5	≤ 10
Electronic weighing taring range	kg	605	1200	1510	2010	3010
Stabilization time	s	20	30	20	30	20

Standard Accessories

Interfaces	RS-232C RS-485	RS-232C RS-485	RS-232C RS-485	RS-232C RS-485	RS-232C RS-485
------------	----------------	----------------	----------------	----------------	----------------

Optional Accessories

Climate station	YCM05C	YCM05C	YCM05C	YCM05C	YCM05C
Software for PC	YSN01C	YSN01C	YSN01C	YSN01C	YSN01C
Draft shield	YDS80C	YDS85C	YDS80C	YDS87C	YDS82C
Calibration weight	YCW853-02	YCW913-02	YCW913-02	YCW913-02	YCW913-02

Dimensions

Weighing pan (side) or (W×D×H)	mm	800×1000×300	1510×1310×300	800×1000×300	1920×1660×300	1000×1250×300
Display (W×D×H)	mm	303×195×90	303×195×90	303×195×90	303×195×90	303×195×90

s* The standard deviation "s" is the repeatability calculated from 6 ABA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Technical Specifications: Determination of Volume, Density, Susceptibility and Magnetism



		VD1005	VL1005	YP50K	YSZ01C	YSZ02C
Maximum capacity	kg	1.125	1.125	50	50	50
Application range		1 g...1 kg	1 g...1 kg	2 kg...50 kg	E2 F1 F2	E1 E2 F1 F2
Readability	µg	10	10	–	10	1
Repeatability s*	µg	≤ 40	≤ 40	–	≤ 20	≤ 8
Repeatability (typical), s*	µg	≤ 20	≤ 20	–	≤ 10	≤ 5
El. weighing taring range	g	350	350	–	10	10
Load alternator	pos.	9 in liquid 9 in air	9 in liquid	–	–	–
Linearity	mg	0.12	0.12	–	0.1	0.05
Range sensitivity	µg/g	20/1	20/1	–	20/1	10/1
Stabilization time	s	20	20	–	15	15

Standard Accessories

Interfaces		RS-232 USB LAN	RS-232 USB LAN	–	RS-232C	RS-232C
Draft shield		Integrated	Integrated	–	Integrated	Integrated
PC Application Software		Yes Yes	Yes Yes	No Yes	No Yes	No Yes
Miscellaneous		<ul style="list-style-type: none"> – Air temperature sensor – Air humidity sensor – Air pressure sensor – 2 temperature sensors in liquid PT100 1 mK – Meniscus compensation 		<ul style="list-style-type: none"> – Aluminum case – Lifting aid – Metering syringe – Temperature-measuring device – Gloves – Test certificate 	<ul style="list-style-type: none"> – RS232 PC connection cable – Susceptometer test certificate – Neodymium-iron-boron magnet – 5 different distances Z_0 (gauge blocks not necessary) 	

Optional Accessories

Climate station		YCM02C	YCM02C	YCM03C	YCM03C	YCM02C
Software for PC		YSN01C	YSN01C	–	YSN01C	YSN01C
Calibration weight		200 g E2 YCW522-00	200 g E2 YCW522-00	–	10 g E2 YCW412-00	10 g E2 YCW412-00
Miscellaneous		<ul style="list-style-type: none"> – YVT01C, thermostat – YWT20C, table for VD1005 & VL1005 – YDR1000SIC, 1 kg silicon sphere with PTB density certificate – YCS31-612-09, set of weights, 1g-1kg with PTB density certificate – YCS51-612-02, set of substitution weights 		<ul style="list-style-type: none"> – CCE60K3 – YLD01C, crane up to 50 kg – YLD02C, crane gripper for weights 	<ul style="list-style-type: none"> – YSZ01RMC, calibration kit for the internal magnet – YSZ01RSC, 1 kg susceptibility standard (1kg) – YLD01C, crane up to 50 kg – YLD02C, crane gripper for weights 	

Dimensions

Sample size (D×H)	mm	95×120	95×120	210×350	300×350	300×350
Measur. unit (W×D×H)	mm	600×600×1600	600×600×1600	–	340×300×250	340×300×250
Control unit (W×D×H)	mm	600×600×1600	600×600×1600	–	160×140×40	160×140×40

s* The standard deviation "s" is the repeatability calculated from 6 ABBA cycles after elimination of drift. Prerequisites for accurate calculation of the standard deviation are good ambient conditions in accordance with OIML R111 for an E1 mass standards laboratory.

Sartorius AG
Weender Landstrasse 94-108
37075 Goettingen, Germany

Phone +49.551.308.0

Fax +49.551.308.3289

info.mechatronics@sartorius.com

www.sartorius-mechatronics.com

www.massmetrology.com

Sartorius AG reserves the right
to make changes to the technology,
features, specifications and design
of the equipment without notice

Specifications subject to change without notice.
Printed in Germany on paper that has been
bleached without any use of chlorine.

W/sart-289 - G

Publication No.: W--1064-e09050

Order No.: 98649-001-54