sartorius

Susceptometer
Innovation in
mass metrology

Innovation in mass metrology:
A compact solution for testing the magnetic properties of weights

With the introduction of the new OIML Directive R111 comes the recommendation that the magnetic properties of weights be tested. This confirms that the requirements placed on weights no longer only apply to geometric quantities, the density of the material comprising the weight, or its surface qualities. On the contrary, many scientific evaluations support the idea that the susceptibility and magnetization of weights must be considered.

Susceptometer method
There are several methods for defining the magnetic properties of weights. The so-called susceptometer method is recommended in OIML Directive R111 for testing weights of the accuracy classes E1, E2, F1 and F2. The new YSZ01C | YSZ02C susceptometer from Sartorius enables you to easily and conveniently determine the susceptibility and magnetization of weights in accordance with OIML R111.

In this procedure, the interaction between a permanent magnet and the weight being tested is determined as a force using a high-resolution balance.

Taking into account the known properties of the test magnet, the distance of the weight from the test magnet and the weight geometry, the desired magnetic quantities of the weight can be calculated.

Compared to other well-known equipment, the Sartorius susceptometer stands out on account of its highly compact design. Integration of the individual components, an innovative turning mechanism for adjusting the position of the test magnet and simple adjustment of the height of the loading platform make working with the susceptometer simple and effective. This significantly improves the repeatability of measurements. The susceptometer is available in two different resolution levels. The YSZ01C features 10-μg resolution, and the YSZ02C has 1-μg resolution.

Application software
The software that comes standard with the susceptometer is very 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 out the array of accessories available for high-resolution balances and mass comparators. Along with 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.

YSZ01C | YSZ02C susceptometer

Technical Specifications

Base dimensions:	338×286 mm
Height:	249 mm
Maximum capacity:	50 kg
Dipole moment of the magnet:	$m \sim 0.1$ Am^2
Geometry ratio of the magnet:	$h/d = 0.87$
Height Z_0 (between base of weight and mid-point of the magnet)	Adjustable in fixed steps: $Z1=18$ $Z2=20$ $Z3=27$ $Z4=35$ $Z5=43$ mm
Field strength due to different height Z_0:	2,700; 2,000; 800; 360; 200 A/m
Readability of the susceptometer:	YSZ01C: 10 mg YSZ02C: 1 mg
Turning mechanism for magnet:	Easy to operate by external rotary knob Marking for N–S orientation of the magnet
Software:	Convenient application software, default parameters and easy, user-defined configurations possible Quick check function Printing of reports, exporting of results
Data transfer protocol:	HTML mode and data transfer to user-specific metrology software via CVS file format
Applications for the Sartorius susceptometer:	OIML R111-compliant testing of weights; please note the tables on the next page for the ranges of susceptibility and magnetization measurements

Data sheet for YSZ01C | YSZ02C susceptometers

Susceptibility measurements

Maximum susceptibility χ according to OIML R111 Recommendation

Nominal Mass	OIML Class E1	E2	F1	F2
2 g	0.06	0.18		
5 g	0.06	0.18		
10 g	0.06	0.18		
20 g	0.02	0.07	0.2	0.8
50 g	0.02	0.07	0.2	0.8
100 g	0.02	0.07	0.2	0.8
200 g	0.02	0.07	0.2	0.8
500 g	0.02	0.07	0.2	0.8
1 kg	0.02	0.07	0.2	0.8
2 kg	0.02	0.07	0.2	0.8
5 kg	0.02	0.07	0.2	0.8
10 kg	0.02	0.07	0.2	0.8
20 kg	0.02	0.07	0.2	0.8
50 kg	0.02	0.07	0.2	0.8

Change in susceptibility χ for $Z_0 = 18$ mm for 1 digit $\Delta\chi$

Model Order No.: Readability: Nominal Mass	YSZ01C 10 µg	YSZ02C 1 µg
2 g	0.00084	0.000084
5 g	0.00047	0.000047
10 g	0.00031	0.000031
20 g	0.0002	0.00002
50 g	0.00012	0.000012
100 g	0.0001	0.00001
200 g	0.00008	0.000008
500 g	0.00006	0.000006
1 kg	0.00006	0.000006
2 kg	0.00006	0.000006
5 kg	0.00006	0.000006
10 kg	0.00006	0.000006
20 kg	0.00006	0.000006
50 kg	0.00005	0.000005

Measuring range of the Sartorius susceptometer*

Model Order No.: Readability: Nominal Mass	YSZ01C 10 µg	YSZ02C 1 µg
2 g	0.042... 1	0.0042... 1
5 g	0.024... 1	0.0024... 1
10 g	0.016... 1	0.0016... 1
20 g	0.010... 1	0.0010... 1
50 g	0.006... 1	0.0006... 1
100 g	0.005... 1	0.0005... 1
200 g	0.004... 1	0.0004... 1
500 g	0.003... 1	0.0003... 1
1 kg	0.003... 1	0.0003... 1
2 kg	0.003... 1	0.0003... 1
5 kg	0.003... 1	0.0003... 1
10 kg	0.003... 1	0.0003... 1
20 kg	0.003... 1	0.0003... 1
50 kg	0.003... 1	0.0003... 1

*) The quantity contributed by the display resolution to the total uncertainty of measurement is ≤ 2% within the range indicated

Magnetization measurements

Maximum magnetization μ_0M_z according to the OIML R111 Recommendation

Nominal Mass	OIML Class E1	E2	F1	F2
2 g	2.5 µT	8 µT		
5 g	2.5 µT	8 µT		
10 g	2.5 µT	8 µT		
20 g	2.5 µT	8 µT		
50 g	2.5 µT	8 µT		
100 g	2.5 µT	8 µT	25 µT	80 µT
200 g	2.5 µT	8 µT	25 µT	80 µT
500 g	2.5 µT	8 µT	25 µT	80 µT
1 kg	2.5 µT	8 µT	25 µT	80 µT
2 kg	2.5 µT	8 µT	25 µT	80 µT
5 kg	2.5 µT	8 µT	25 µT	80 µT
10 kg	2.5 µT	8 µT	25 µT	80 µT
20 kg	2.5 µT	8 µT	25 µT	80 µT
50 kg	2.5 µT	8 µT	25 µT	80 µT

Change in magnetization $\Delta\chi$ for $Z_0 = 18$ mm for 1 digit $\Delta\mu_0M_z$

Model Order No.: Readability: Nominal Mass	YSZ01C 10 µg	YSZ02C 1 µg
2 g	1.8 µT	0.18 µT
5 g	0.9 µT	0.09 µT
10 g	0.6 µT	0.06 µT
20 g	0.4 µT	0.04 µT
50 g	0.2 µT	0.02 µT
100 g	0.2 µT	0.01 µT
200 g	0.1 µT	0.01 µT
500 g	0.1 µT	0.01 µT
1 kg	0.1 µT	0.01 µT
2 kg	0.1 µT	0.01 µT
5 kg	0.1 µT	0.01 µT
10 kg	0.1 µT	0.01 µT
20 kg	0.1 µT	0.01 µT
50 kg	0.2 µT	0.02 µT

Measuring range of the Sartorius susceptometer**

Model Order No.: Readability: Nominal Mass	YSZ01C 10 µg	YSZ02C 1 µg
2 g	18 µT...1 mT	1.8 µT...1 mT
5 g	9 µT...1 mT	0.9 µT...1 mT
10 g	6 µT...1 mT	0.6 µT...1 mT
20 g	4 µT...1 mT	0.4 µT...1 mT
50 g	2 µT...1 mT	0.2 µT...1 mT
100 g	2 µT...1 mT	0.2 µT...1 mT
200 g	1 µT...1 mT	0.1 µT...1 mT
500 g	1 µT...1 mT	0.1 µT...1 mT
1 kg	1 µT...1 mT	0.1 µT...1 mT
2 kg	1 µT...1 mT	0.1 µT...1 mT
5 kg	1 µT...1 mT	0.1 µT...1 mT
10 kg	1 µT...1 mT	0.1 µT...1 mT
20 kg	1 µT...1 mT	0.1 µT...1 mT
50 kg	2 µT...1 mT	0.2 µT...1 mT

**) The quantity contributed by the display resolution to the total uncertainty of measurement is ≤ 10% within the range indicated

YSZ01C | YSZ02C software interface