Installation and Operating Instructions

Sartorius Susceptometer
YSZ 01C | 02C

98647-003-50

Contents

Intended Use

With the introduction of the new OIML Recommendation 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 conducted using the most modern weighing instruments with the highest resolution support the idea that the susceptibility and magnetization of weights must be considered.

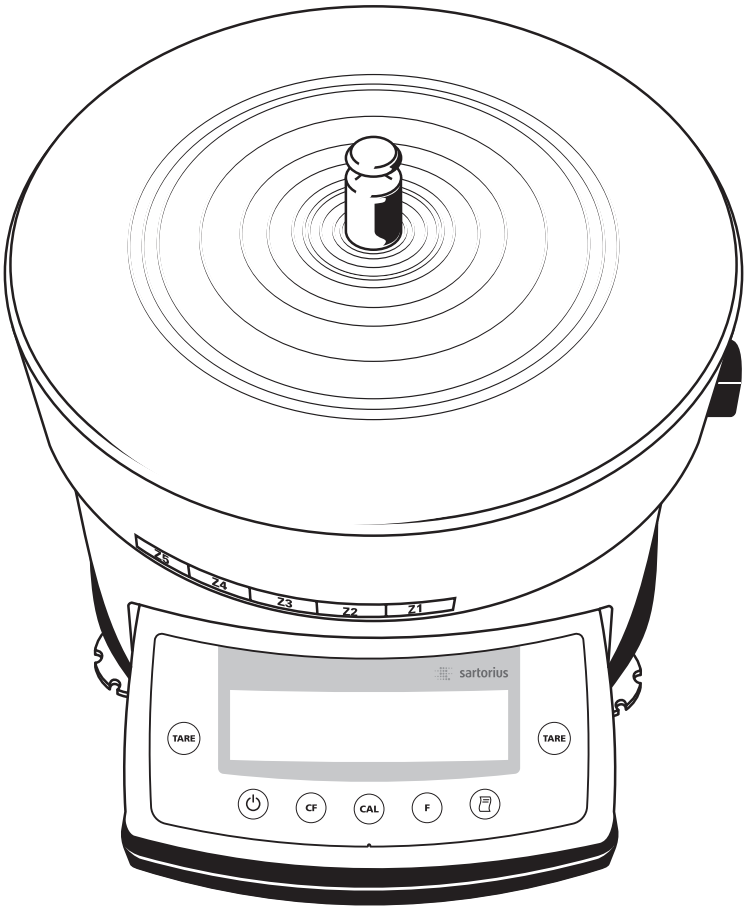
There are various methods for defining the magnetic properties of weights. The susceptometer method is recommended in OIML Recommendation R111 for testing weights of the accuracy classes E1, E2, F1 and F2.

The new YSZ1C|YSZ02C susceptometer from Sartorius enables you to easily and conveniently determine the susceptibility and magnetization of weights in accordance with OIML R111. The functions of the susceptometer exactly follow the principal included in the section B.6.4, “Magnetic susceptibility and permanent magnetization, the susceptometer method.”

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

The YSZ 01C|02C susceptometer from Sartorius features an exceptionally compact design that is user-friendly and requires little effort on the part of the operator. This sets it apart from other equipment used for similar measurement procedures.

At the core of the susceptometer is a Sartorius mass comparator with a resolution of 10 µg or 1 µg. This is securely mounted on a stable base plate and surrounded by a housing that is resistant to air and temperature changes and holds the loading platform onto which samples are placed.



In comparison to other well-known designs, the YSZ01C|02C is much easier to work with and much more effective. Reproducibility of measurements is also significantly improved.

An absolute novelty of the susceptometer is the way in which the test magnet is handled. For adjustment of the particular measuring position of the magnet, a knob is mounted on the side of the unit. This knob activates a turning mechanism for the test magnet and eliminates the need to open the measuring chamber and directly access the magnet. The magnet pole position that has been adjusted is indicated by the colored markings on the adjustment knob. If the red marking is pointing upward, the North pole of the magnet is positioned upward.

Depending on the accuracy classification of the sample, a distance is selected between the sample and the test magnet before measurement begins. More information on selecting the appropriate distance can be found in the section entitled “Operation” (p. 13). The distance must be adjusted in every case so that allowable magnetic field strengths are not exceeded.

Colored markings for distances Z1 through Z5 highlight this special feature (red indicates a dangerous setting).

This distance can be adjusted simply by turning the loading platform and at the same time gently lifting or lowering it.

Customized software 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. Geometry-dependent parameters for weights with standard geometry can be retrieved from a database, and special shapes can be simulated using an integrated program.

Special information about installation and working with the susceptometer is included in the section entitled “Operation” on page 13.

Warning and Safety Information

Safety

● To avoid damaging the unit, please carefully read this instruction manual before starting up the susceptometer.

⚠ Do not allow the powerful test magnet used for measurements with the susceptometer to be placed near weights because there is a risk that the weights could be damaged by magnetic fields (magnetized). The susceptometer should only be used for applications described in this instruction manual. Other equipment or objects that react to magnetic fields (e.g., credit cards, storage media, electronic instruments) could be influenced or damaged.

⚠ You can use a standard weight to calibrate the mass comparator. To do so, simply place the weight onto a specially designed area of the magnet holder. To ensure that unallowable magnetic fields do not influence the standard weight, you must remove the magnet turning apparatus and place it in a secure location. In the process, also ensure that the powerful test magnet is not placed near sensitive objects.

⚠ Weights can only be exposed to magnetic fields to a limited extent. Limits for surrounding magnetic fields must be maintained. If these limits are exceeded, the weights may become unusable for their accuracy class. Therefore, the distance settings for the loading platform must be determined exactly for each weight being analyzed. In addition, colored markings for positions Z1 to Z5 indicate dangerous areas for samples and standard weights. These occur for certain accuracy classes of weights when the allowable magnetic field strengths are exceeded by the magnetic field generated by the test magnet (see the section entitled “Operation” for more information).

⚠ Magnetic materials (e.g., reinforcement plates under balance tables, threaded bushes in the stone slab and similar equipment, electronic devices, computers, laptops and monitors) should be kept at a greater distance from the susceptometer. Otherwise, influences on the results of measurements cannot be ruled out. Also with direct usage, be sure that the results of measurements are not skewed by watches or clocks, keys, mobile telephones, writing instruments, metal items on clothing, or similar objects. Forceps and handling elements used with the susceptometer must be non-magnetic.

⚠ Use only test magnets from Sartorius in the susceptometer. Otherwise, proper functioning of the equipment cannot be guaranteed.
All original Sartorius test magnets are clearly marked with an inscription and are therefore easy to distinguish.
The code number of the test magnet installed in the unit is indicated on the calibration certificate.

⚠ Do not use the susceptometer in areas where there is a risk of explosion.

⚠ Only allow properly trained service technicians to open the mass comparator.

⚠ Unplug the unit from AC power prior to connecting or disconnecting additional equipment.

⚠ In areas of operation with higher safety requirements, valid installation regulations must be observed.

Do not allow liquids to enter the unit housing during cleaning: use only a damp cloth to clean the equipment.

Installation

⚠ The voltage rating printed on the AC adapter must coincide with the local line voltage rating.

– Be careful if using unfamiliar or commercially available RS-232 interface cables: the pin assignments are often not suitable for use with Sartorius equipment.
Please check the pin assignments using the connection diagrams before connecting equipment, and disconnect wires that are not assigned in accordance with Sartorius connection diagrams.

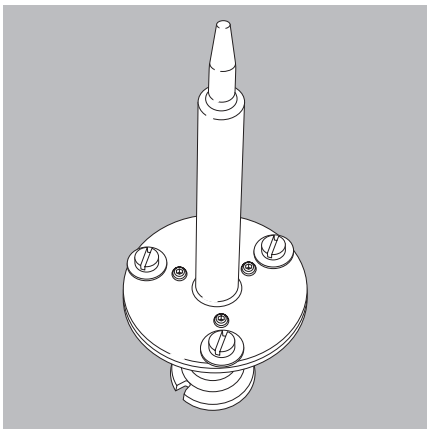
⚠ If there is visible damage to the susceptometer or power cord, disconnect the equipment from AC power and lock it in a secure place to ensure that it cannot be used for the time being.

– Accessories and options from Sartorius are designed for use with the unit and are optimal choices. Therefore, do not devise your own solutions. The operator shall be responsible for any modifications to Sartorius equipment and for any connections of cables or equipment not supplied by Sartorius. In addition, the operator must check and, if necessary, correct these modifications and connections. On request, Sartorius will provide information on the minimum operating specifications (in accordance with the Standards for defined immunity to interference).

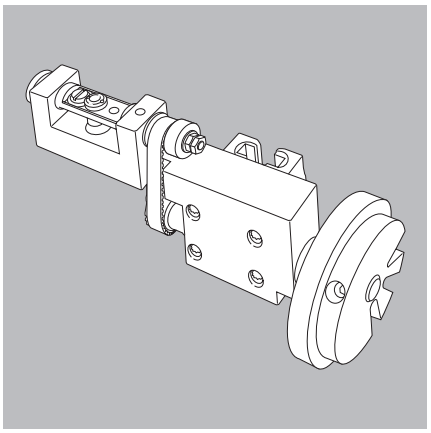
○ Do not open the mass comparator. If the safety seal on the unit has been tampered with, you will forfeit your right to claim the benefits of the warranty.

○ If you encounter any problems, please contact the Sartorius Customer Care department.

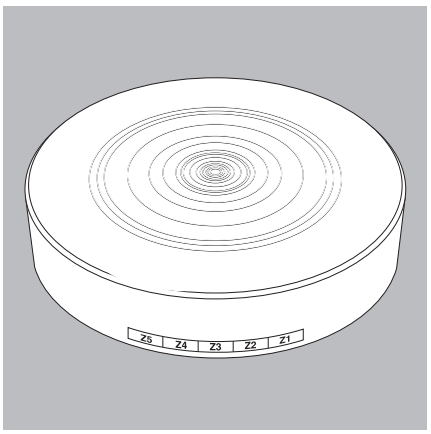
Magnet holding device with positioning notch



Magnet-turning appartus with test magnet



Loading platform with markings for precise positioning of weights and for positions Z_1 through Z_5



Storage and Shipping Conditions

– Do not subject the mass comparator to extreme temperatures, shocks, blows, vibrations or moisture.

Condition of Unit upon Delivery

For technical reasons, the susceptometer cannot be delivered completely assembled. However, it is designed to allow you to assemble it yourself at the location where it will be used. Information required for assembling the unit and about the software and organization of measurements can be found in the following sections.

⚠ Important note:
All fundamental settings specific to each susceptometer model have been adjusted at the factory. To prevent alterations, the adjustment screws have been secured with tamper-proof varnish. These settings may not be changed.
The feet on the mass comparator are not adjustable.

The mass comparator can only be leveled horizontally via the leveling feet on the basic unit (susceptometer).

Equipment Supplied

The susceptometer comes partially assembled.
Delivery consists of two packages.

1st package:
- 1 µg or 10 µg mass comparator
- Loading platform
- Magnet turning apparatus with test magnet
- Magnet support
- Installation and operating instructions
- Draft shield ring
- Calibration certificate

2nd package:
- Basic unit
- Electronics box
- AC adapter
- Software (CD)
- Interface cable to link the mass comparator to a PC

Unpacking the Equipment

● As soon as you have unpacked the mass comparator, check it to ensure that the exterior has not been damaged in transit.

○ If the unit has been damaged, please refer to the information under "Care and Maintenance" in the section entitled "Safety Inspection."

○ Keep all parts of the original packaging in case you need to ship the equipment for repairs, etc. If you do ship the susceptometer, please disconnect all cables before you package it.

Setting up the Unit

When choosing a location to set up the susceptometer, avoid the following adverse influences:

- Heat (from radiators, heaters or direct sunlight)
- Drafts from open windows or doors
- Shocks or vibrations during weighing
- Extreme moisture

⚠ Magnetic materials (e.g., reinforcement plates under balance tables, threaded bushes in the stone slab and similar equipment, electronic devices, computers, laptops and monitors) should be kept at a greater distance from the susceptometer. Otherwise, influences on the results of measurements cannot be ruled out. Also with direct usage, be sure that the results of measurements are not made erroneous by watches or clocks, keys, mobile telephones, writing instruments, metal items on clothing, or similar objects. Forceps and handling elements used with the susceptometer must be non-magnetic.

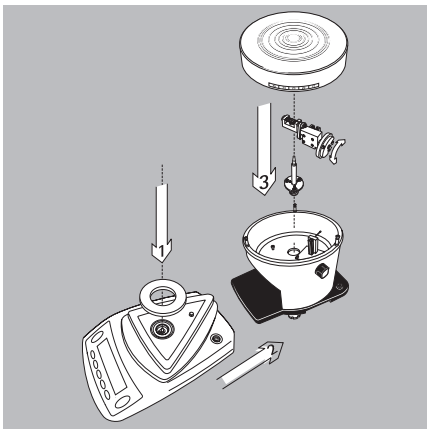
Conditioning the Unit to the Ambient Temperature

Moisture can condense on the surfaces of a cold mass comparator whenever it is brought into a warmer place. Therefore, make sure to condition it for about 2 hours at room temperature, leaving it unplugged from AC power.

Selecting a Location for the Susceptometer

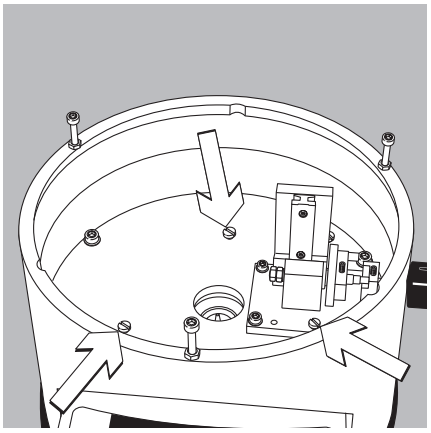
The Sartorius susceptometer is an instrument used to test the magnetic properties of materials, especially for weights of the accuracy classes E1, E2, F1 and F2. With regard to climatic conditions and cleanliness, the location where the unit is installed should conform to the requirements imposed on measurement laboratories that conduct precision measurements. For more information, please refer to OIML R111 [2].

Depending on measuring tasks to be performed and the measurement principle used, particular attention should be paid to the surface where the unit will be set up and the environment in which it will operate.

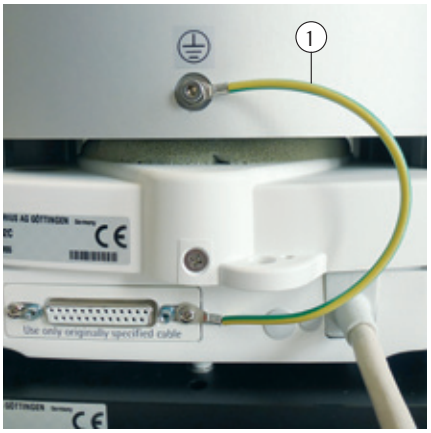


Assembling the Susceptometer
At the location you have chosen, position the basic unit, mass comparator, electronics box and draft shield ring so that they are within easy reach. These will be assembled in the first step.

Keep the magnet turning apparatus, magnet holding device and loading platform close by. To begin assembly, level the basic unit at the location where it will be used. The unit is level when the air bubble in the leveling indicator on the base plate is within the centering circle. The next step is to insert the mass comparator into the basic unit. Before you perform this step, you must first do the following:



- Check that the 3 plastic safety screws in the intermediate plate of the basic unit have been tightened all the way to the top so that they do not hinder the comparator from being inserted into the basic unit.
- Place the separate draft shield ring on the mass comparator.
- Place a sheet of paper on the mass comparator so that it covers the draft shield strip. This makes it much easier to insert the mass comparator into the basic unit.



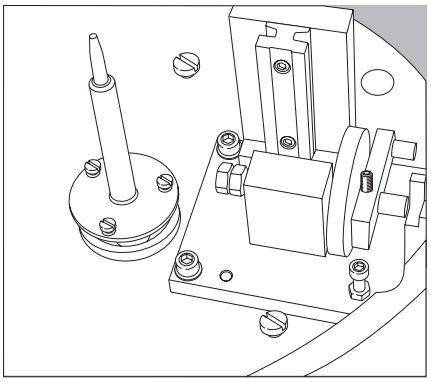
- Attach the grounding cable (1) to the rear of the device.

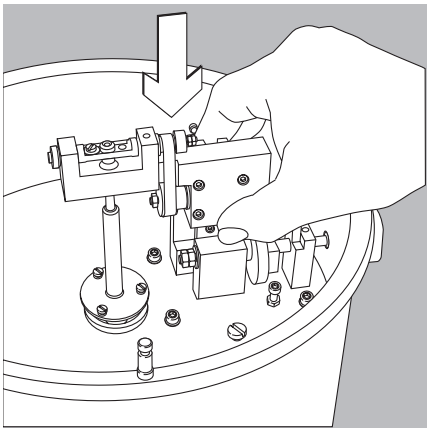
Once these preliminary steps have been taken, you can insert the mass comparator into the basic unit. To do so, first guide the power cord through the assembly toward the back of the unit.
Then use your hands to lightly press down on the sheet of paper and draft shield strip and carefully slide the mass comparator into the front side of the basic unit.

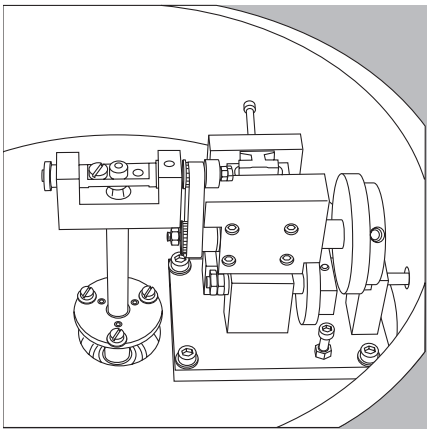
In the process, always slightly lift the mass comparator. Once the feet of the mass comparator have been placed in their respective positions (by lightly pressing against the mass comparator you can make sure that the feet are securely in place) remove the sheet of paper through the front side of the unit.

When you do this, the draft shield strip might flip over toward the front. If this happens, use a suitable, flat object to return the strip to its proper position. It is easy to see whether the unit has been properly installed. The upper surface should be flush against the underside of the intermediate plate and provide the required protection from drafts.

Afterwards, slightly tighten the pressure screws by hand. These prevent the mass comparator from being lifted out of the basic unit and should not exert any pressure on the equipment. If they are tightened too much they can have an effect on the technical properties of the mass comparator.







Now the magnet holding device can be placed onto the pan support pin of the mass comparator. When doing this, be sure that the notch near the bottom of the magnet holding device is correctly positioned. This notch must point toward the rod in the pan support pin. It is also important that the magnet holding device be gently and carefully positioned on the unit without any force. Otherwise, the pan support pin of the mass comparator could be damaged.

The next step is to install the magnet turning apparatus along with the test magnet. First remove the protective transport device from underneath the magnet in the magnet turning apparatus and adjust the knob on the basic unit so that the green mark is pointing upward. The green cutout on the locking disk of the magnet turning apparatus must be positioned so that it fits onto the pins that are already in the unit (which are also green). Then place the magnet turning apparatus onto the guide from the top and slowly lower it. In doing so, ensure that the magnet can easily position itself on the magnet holding device.

If this is the case, you can turn the knob on the side of the unit. The magnet must be able to move upward, turn at the highest position and return to the magnet holding device. In the process, please observe the following:

- Whether the magnet can be easily positioned on the cone of the magnet holding device
- When the magnet turning apparatus has been lowered, the magnet must be positioned symmetrically to the magnet holding device and free on all sides. If the knob is slightly moved, the readout should not change considerably.

Then connect the device to the electronics module as described in the section “Connecting the Susceptometer to AC Power” (page 11), switch it on and wait for the display to appear. This can take some time if the environment is subject to high levels of interference. The waiting time can be reduced by sealing the unit with its loading platform.

Once you have completed assembly and ensured that the mass comparator is functioning properly, you should level it horizontally again. To prevent the susceptometer from tipping, especially when heavy loads are placed on it, retractable feet have been provided to keep the unit steady. They are located at the back corners of the base plate and should be gently lowered until they reach the balance table.
Please note that the retractable feet must not influence the horizontal levelness of the unit.

Once you have made all required adjustments and ensured the proper functioning of the unit, you can install the loading platform. We recommend that the operator place the platform onto the unit so that the mark for position Z4 on the right end of the platform points to the front mark on the basic unit.

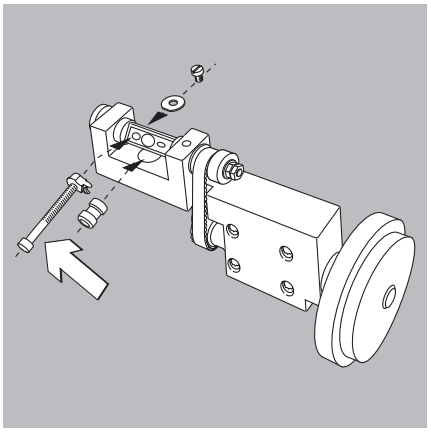
Afterwards you should check the unit again to ensure that the moving parts are performing as they should:

- Turn the knob to operate the magnet turning apparatus.
- Turn, lift or lower the loading platform.

Once the unit has been allowed to rest for an appropriate period, adjust the “green mark: up” setting. The weight unit “g” on the display indicates a valid readout. At this point, the unit can be tared. The susceptometer readout will indicate zero for a considerable time if the unit has thermally adjusted to the ambient conditions.

When placing the loading platform onto the unit, ensure that it is absolutely parallel to the upper edge of the housing. Otherwise it might get stuck. The correct measuring position has been set if the loading platform “clicks” onto the support pins at each adjusted distance level (positions Z1 to Z5). After the distance level has been changed, the measuring position is reached when the loading platform has turned all the way to the left stop. If you place the platform onto the susceptometer at this position, the unit will automatically center the platform and you will hear the “click” mentioned previously. You should try changing the distance levels a few times before you begin a measurement.

If all functions are in order, a readout between –0.000800 g and -0.001200 g will appear on the display once the test magnet has been turned via the knob on the side of the unit. This value is dependent on the vertical magnetic field at the weighing location.
Once you have performed the tests mentioned above, the unit is ready to begin a measurement.



Changing the Magnet
If the magnet needs to be changed for scientific reasons, proceed as described below:

- To change the magnet, remove the loading platform.

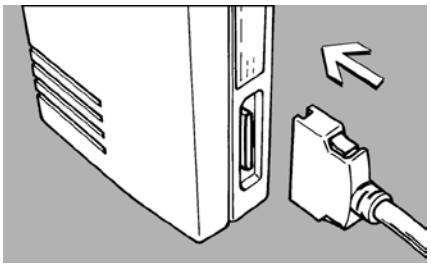
- Then raise the magnet turning apparatus until the magnet has turned by approximately 90°. At this point, the surfaces of the knob are in a horizontal position.

- Next loosen the plastic screw and remove it along with the safety disk.

- Then insert the antimagnetic screw provided (see arrow) (M3×45), turn it from the South pole side into the fastener, and remove the fastener toward the South pole. The fastener can only be removed toward the South pole.

  The M3 screw for handling the safety disk is located at the back of the guide.

Now you can remove the magnet by gently lifting and turning it toward the larger opening and then pulling it through the opening. Follow the instructions in reverse order to place a new magnet into the unit. The engraved code number on the test magnet corresponds to the North pole and must point toward the red marking. Once the safety disk has been placed back into the unit, you can lower the magnet onto the magnet holding device using the knob on the side of the unit. As previously described, you should test the functions of the unit again before beginning a measurement.



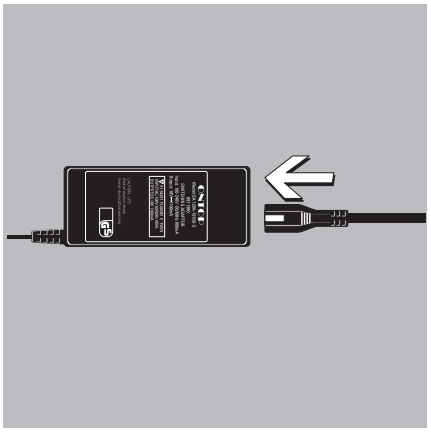
Connecting the Mass Comparator to the Electronics Box

– Insert the interface cable connector into the socket on the electronics box.

Connecting the Susceptometer to AC Power

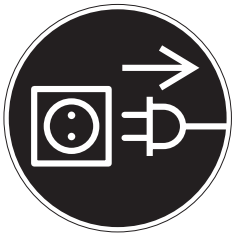
○ Use only original Sartorius AC adapters. The protection rating of the AC adapter corresponds to IP20 in accordance with EN60529.

● Insert the angled connector of the AC adapter into the electronics box.



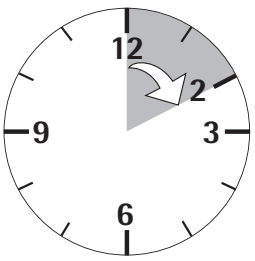
Insert the power cord into the universal power supply.

○ Sartorius universal power supply with broad input voltage range of 100...240 V~, Order no. 6971966 and interchangeable power cord:
6900900 (Europe)
6900901 (US | Canada)
6971945 (UK)
6900905 (Australia)
6900902 (ZA)



Safety Precautions

On the AC adapter:
The AC adapter rated to class 2 can be plugged into any wall outlet without taking any further safety precautions.
On the universal power supply 6971966:
The power supply rated to class 1 may be connected to any wall outlet with a protective ground | earth connection (PE). The ground terminal is connected to the mass comparator housing, which can be additionally grounded for operation. The data interface is also galvanically connected to the mass comparator housing (ground).



Connecting Electronic Components (Peripherals)

● Before connecting or disconnecting additional equipment (printer, PC) to the data interface, be sure to unplug the mass comparator from AC power.

Warmup Time

To ensure precise results, allow the unit to warm up for 2 hours before working with it so that the required operating temperature can be reached.

Initial Steps

Installing the Software
Once the mass comparator has been installed and a sufficient amount of time has passed to allow the equipment to become conditioned to the environment, you can begin conducting measurements with it. When evaluating the readings, there are two possibilities for determining the magnetic quantities.

- Manual calculation according to the directive indicated in [2]
  (see Literature on page 38)

- Using the Sartorius susceptometer software supplied with the unit.

  Sartorius recommends using the software provided because it makes working with the susceptometer easier and more convenient and all operational sequences to be performed are shown step by step. Readings from the mass comparator can be automatically transferred to a PC via the serial interface. The software performs all necessary calculations, generates printouts and exports data into higher-level database programs. Recalibrating the susceptometer is significantly easier because this procedure is supported by the software.

  Install the software on a PC that is set up near the susceptometer, and connect the mass comparator to the PC using the serial interface cable provided.

  More detailed information about the installation sequence and system requirements can be found online in the manual file supplied with the software. Ensure that the distance between the PC and the susceptometer is great enough to rule out magnetic interactions (which could make results erroneous). The distance should be at least 1 m, although in certain cases you should conduct your own experiments.

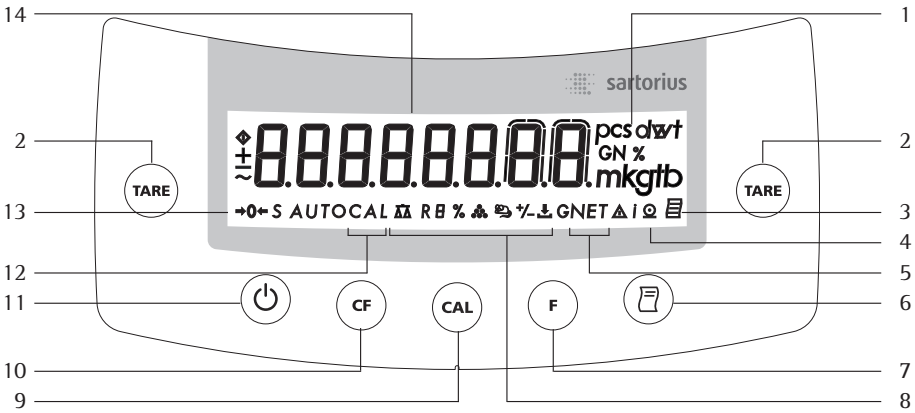
  Information about settings in the balance operating menu for use with the software can be found in the online documentation for the software. These settings have been preset at the factory. No matter if you are using the software or not, the auto zero function on the mass comparator must be switched off (see Menu Settings beginning on page 21).

Entering Data from the Calibration Certificate
Once the software has been installed and a serial connection has been established, the calibration data from the calibration certificate must be entered into the software. These coefficients were individually determined by Sartorius for each unit and enable measurements to be conducted with basic accuracy (see the section entitled “Calibration” for more information). Upon initial startup of the software, you will be prompted to enter calibration data after you have selected a language. In the process, the calibration window will open automatically. When you use the software at a later time, you can always reopen the calibration window by selecting “Extras” and “Calibration” in the menu.

Set the changing mode to manual and enter the values for m and Z1, Z2, Z3, Z4 and Z5 from the calibration certificate. Change the values for g and Hez to the acceleration due to gravity and the vertical component of the magnetic field at the location where the unit is set up (see “Calibration” for more information).

In the configuration window, enter the serial number of the susceptometer under “Other.” The serial number entered here will then automatically appear in records of the measurement.

Overview of the Display Elements and Function Keys

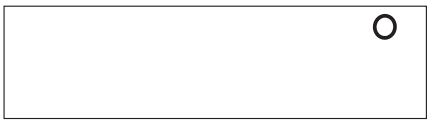


Position	Designation
1	Weight units
2	Taring
3	Symbol for “GLP-printout active”
4	Symbol for “Printing active”
5	Display: Memory full for net-total application program
6	Data output: This key activates the output of displayed values via the integrated data interface.
7	Function key: Start application program
8	Diagram for selected application
9	Start calibration or adjustment procedure

Position	Designation
10	Clear Function: This key is generally used to cancel functions: – Quit application programs – Cancel calibration or adjustment procedure in progress
11	On | Off
12	Display: Calibration | adjustment function
13	Symbol for standby mode or zero range
14	Weight displayed according to selected basic unit

Features
- Taring susceptometer.
- Assigning IDs to weights (if necessary).
- Printing the weight.

Preparation
If a circle appears in the upper right-hand side of the display, the mass comparator was disconnected from AC power (because the unit is being connected for the first time or due to a power outage).



● Switch on the mass comparator: press the I/⏻ key
> All symbols appear briefly in the display.

> Next the mass comparator conducts a test of the display.

○ If necessary, tare the mass comparator: press the TARE key.
After the unit is initially switched on, the ⏀ symbol is displayed until the first key is pressed.
When the ⏀ symbol is displayed during operation: the balance processor is currently processing a function and therefore cannot accept further assignments at the moment.

Additional function:
● To switch off the mass comparator: press the I/⏻ key
If a circle appears in the lower left-hand side of the display: the display has been switched off.
The mass comparator is now in standby mode.

With the Sartorius susceptometer, you can determine the magnetic quantities of susceptibility and weight magnetization. The principal design and mode of operation correspond to those described in section [1]. The following section will describe working with the Sartorius susceptometer. All terms and formula symbols correspond to those used in sections [1] and [2]. Operators of the Sartorius susceptometer should be very familiar with OIML Directive R111, especially with section B.6.4 entitled "Magnetic susceptibility and permanent magnetization, the susceptometer method," and with the article by R.S. Davis entitled "Determining the Magnetic Properties of 1 kg Mass Standard."

Sequence of Measurement

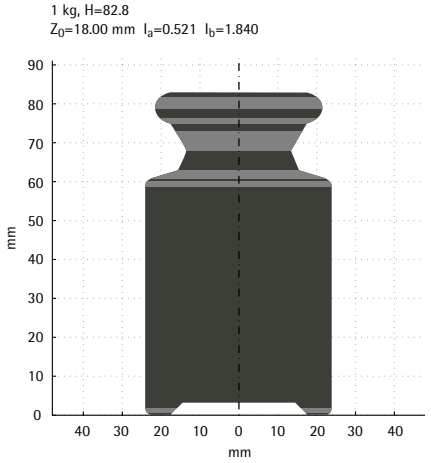
The sequence of measurement using the susceptometer is described step by step in section [2]. If you elect to use the software provided with the Sartorius susceptometer, you will be guided through the measurement procedure step by step. The principle sequence is as follows:

- Determine the sample geometry
- Enter the name and error class of the sample as well as other data
- Set the vertical position
- Conduct the measurement
- Evaluate the data and generate a record

Sample Geometry
The geometry of the sample can be selected from a database of OIML knobbed weights or entered as a cylinder including the height and diameter.
Alternatively, any rotationally symmetrical geometry can be entered as a composition of cylindrical layers where geometry factors L_a and L_b are calculated automatically.
As described in reference [1], cylindrical layers are calculated by equations (6a), (6b) and (10).

In addition to the knob on top, typical knobbed weights have rounded edges and often have a recessed base. Using the software, you can create a detailed approximation of these types of samples.
Because it is possible to describe individual layers as cylinders or truncated cones, fewer layers are necessary. For truncated cones, the respective equations are integrated numerically.

This kind of geometric approximation enables the operator to create a good likeness for practical measurements, even when only a few layers are involved.
The calculation of inner and outer peripheral cylinders as described in reference [1] is not necessary but is nevertheless possible. Furthermore, the geometric factors are also very easy to calculate for inverted measurements with the knob of the weight pointing downward.



Geometric approximation of a 1 kg OIML knobbed weight. For clearness, the layers have alternating colors.

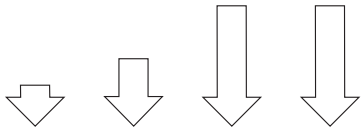
Sample Data
Sample data (a description of the sample, nominal value, etc.) and any data that describe the sample and its conditions in greater detail can be entered. On the record of measurement, these data document and differentiate among various measurements. They are also stored in an exported data set.

Vertical Position
The maximum magnetic field generated by the magnet with magnetic moment m_d located on the underside of the sample is [1,2]:

$$H = \frac{m_d}{2\pi \times Z_0^3}.$$

The vertical distances Z_0 (Z1 – Z5 on the unit) that can be selected by turning the loading platform and the corresponding field strengths are indicated in the table on the following page.

Position	Color	Nominal value Z_0 in mm	Field strength in A/m	Class E1	E2	F1	F2
Z5	Green	43	200				
Z4	Orange	35	360				
Z3	Orange	27	800				
Z2	Red	20	2000				
Z1	Red	18	2700				



According to section [2], the field strengths H, which may not be exceeded during the first test of a weight, are 2000 A/m for weights in accuracy class E1, 800 A/m for class E2 and 200 A/m for classes F1 and F2. It is important to maintain these limits to avoid permanently magnetizing the samples. The vertical distance may only be minimized if the readings on the susceptometer are too low. The distance that should be adjusted for the first test of a weight depends on the accuracy class of the weight and is indicated in the table. The gradual decreases are symbolized here by arrows.

The vertical positions that can be selected are indicated by Z5, Z4,..., Z1 on the cover. The colors (red, orange and green) assigned to the settings indicate the danger of distances that are too small or magnetic field strengths that are too great. Depending on the accuracy class of the sample, the software suggests the appropriate vertical position. In the quick measurement mode, this suggestion can be changed. However, this should only be done if the danger of permanent magnetization of the sample can be ruled out based on reliable previous knowledge.

Measurement
The necessary steps for the actual measurement are indicated by the software in the instruction window. The individual steps of a measurement sequence in vertical position Zi are as follows:

- Turn the test magnet to the 'S' position
- Tare the mass comparator
- Place the sample on the platform
- Determine the value m1 for Zi
- Remove the sample
- Turn the test magnet to the 'N' position
- Tare the mass comparator
- Place the sample on the platform
- Determine the value m2 for Zi
- Remove the sample

Depending on the setting in the operating menu, data are transferred either by manual input or automatically via the serial data interface. In the normal operating mode, you can tare the mass comparator manually or with the software.
The quick measurement mode enables experienced operators to work even faster because several steps can be completed without having to confirm each one.

The measurement sequence is automatically repeated at the next lower position in case the readings for m1 and m2 are too low. The threshold used to make this decision is preset at 30 µg following installation of the software and can be adapted to your individual requirements in the "Options" menu. If a reading exceeds a certain critical threshold, the software will respond by giving a corresponding warning. This critical threshold is preset at 1000 µg and can also be changed if necessary.

Evaluating Data and Generating a Record
Once the measuring sequence has been successfully completed, you can begin to generate records.

All records are stored in the folder selected under the "Options" menu. If you would like data to be exported in CSV format, these data will be stored in the corresponding folder. Exported data can easily be imported into the usual Office programs, database applications or your own applications. This allows individual records to be generated, the history of individual samples to be analyzed or groups of samples (e.g., sets of weights) to be combined and further processed.

Calibration and Adjustment

Purpose
Calibration is the determination of deviations between the readout and the true mass of the sample. During a calibration procedure, the mass comparator cannot be accessed and changes cannot be made.

Adjustment is the activity that eliminates the deviation between the weight displayed and the true mass of the sample or reduces it to the allowable margins for error.

Features
An adjustment procedure can only be started if
- the mass comparator is unloaded
- the mass comparator has been tared
- the internal weighing signal is stable

If these requirements are not fulfilled, an error message will be displayed (Err 02).

Adjustment can be performed
- automatically following calibration (↓ 10 1) or
- manually following calibration, if necessary (↓ 10 2).

The weight of the sample on the platform can only deviate from the target by a maximum of 2 %.

Adjustment can be performed using various weight units: g, kg, lb (↓ 11 1 to 3, factory setting: ↓ 11 1)

The keypad on the mass comparator can be locked for calibration purposes:
- Select code ↓ 9 7

Calibration and Adjustment Sequences
The following settings can be adjusted in the operating menu:
- Calibration and adjustment always performed as one procedure (↓ 10 1, factory setting)

- Following calibration you have a choice of ending the procedure or beginning adjustment (↓ 10 2)

  If no deviations are detected during calibration, you can quit the calibration | adjustment procedure.
  Two keys are then active:

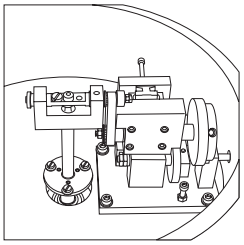
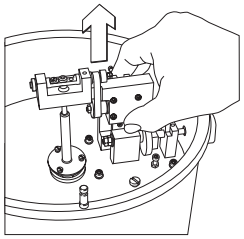
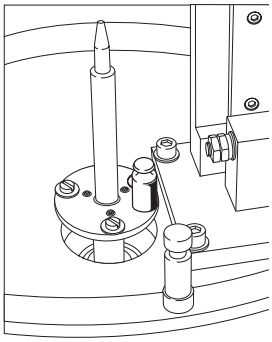
- The (CAL) key to start adjustment

- The (CF) key to end the procedure

Example
The mass comparator of the susceptometer can be externally adjusted or checked with a 10 g weight.
Before doing this, it is necessary to first remove the loading platform and then the magnet turning apparatus (2) with the built-in test magnet as shown in the pictures.

Be sure to keep the magnet turning apparatus at a safe distance from the weights. This apparatus carries the powerful test magnet that is used for measurements performed with the susceptometer. Otherwise there is a risk that weights could be damaged by magnetic fields (magnetized).

The platform of the magnet holding device acts as a weighing pan. We recommend that you place the cover on the unit during measurement to prevent interfering influences from having an effect on the results (3).

Step	Key (or instruction)	Readout
1. Remove the loading platform.		
2. Remove the magnet turning apparatus with the built-in test magnet. Place the cover on the unit during measurement to prevent interfering influences from having an effect on the results.		
3. Tare the mass comparator.	TARE	0.000000 g
4. Start the adjustment procedure.	CAL	+ 10.000000 g CAL ⚠
5. Place the calibration weight indicated in the display on the platform (here 10 g).		
6. The mass comparator is calibrated (only visible if code 1102 is set)		– 0.000002 g CAL ± ⚠
7. If the setting “Calibration and adjustment in one procedure” (1101) is selected, the mass comparator will be automatically adjusted following calibration.		AdJuSt* CAL
8. Adjustment complete.		CC CAL
9. Following adjustment, the calibration weight is displayed with the weight unit symbol.		+ 10.000000 g
10. Remove the calibration weight.		0.000000 g
11. Place the magnet turning apparatus back into the unit.		
12. Replace the loading platform.		

* Display can only be adjusted under menu code 1102.

In addition to the actual values m1 and m2 and the geometry of the sample, you will need the following constants (see [1,2]) to calculate the magnetic quantities susceptibility and magnetization:

- g Acceleration due to gravity at the location of measurement
- Hez Vertical component of the magnetic field at the location of measurement
- m Magnetic dipole moment of the test magnet
- Zi Distance from the center of gravity of the test magnet to the lower edge of the sample

The numerical values for these constants used by the Sartorius susceptometer software and used during calculation can be entered manually in the **Extra** menu under "**Calibration**." The software supports determination of vertical distances Z1 to Z5 using a standard of known susceptibility.

Acceleration Due to Gravity
Here, use the value for the acceleration due to gravity at the location of measurement.

Vertical Component of the Magnetic Field
Use the value for the vertical component of the magnetic field at the location of measurement.
A reference to this value is given below [2]:

> "HEZ is the vertical component of the ambient magnetic field strength in the laboratory. Usually, HEZ can be taken as the vertical component of the earth's magnetic field strength at the location of the laboratory, in which case –60 A/m < HEZ < 60 A/m depending on latitude. The magnitude of HEZ is zero at the earth's equator and maximum at its poles. The sign of HEZ is positive in the Northern hemisphere and negative in the Southern hemisphere.«

If Hez cannot be determined with another measuring instrument, this value should be used as the first approximation. Calculation of the susceptibility is not dependent on the value of Hez. However, when determining the magnetization, the value for Hez is included in the calculation.

Magnetic Dipole Moment of the Test Magnet
The magnetic dipole moment of the test magnets used in Sartorius susceptometers is determined before the units are shipped and is recorded in the calibration certificate. It is possible to redetermine the magnetic dipole moment using the procedure described in section [3]. To do so, you will need 3 additional magnets with approximately the same magnetic dipole moment and a spacer. The method is based on measuring the force between each pair of four magnets and solving the resulting over-determined system of equations with 6 equations and the 4 unknown magnetic dipole moments. Since each of the four magnets must be placed on the magnet holding device for this procedure, it is vital that only original Sartorius test magnets are used. All original test magnets are clearly numbered and therefore easily distinguished from others.
The code number engraved on the built-in test magnet is indicated in the calibration certificate.

To redetermine the magnetic dipole moment using three additional test magnets, Sartorius offers a calibration set that is not part of the standard equipment supplied. For this procedure, the built-in test magnet can be removed from the magnet turning apparatus (see the section entitled "Installation"). Again, please ensure that the powerful test magnet is kept away from sensitive devices and weights because there is a risk of weights being damaged by magnetic fields (magnetized).

Vertical Distances
The vertical distances from the center of gravity of the test magnet to the lower edge of the sample do not require a mechanical setting. The spacers and balance feet have been secured with tamper-proof varnish to prevent them from being adjusted and may not be changed. As a result of the extremely stable mechanical structure of the unit, the vertical distances on the Sartorius susceptometer are practically immune to changes. The values for the vertical distances determined by Sartorius prior to shipment of the susceptometer are indicated in the calibration certificate that was included with the unit. Using these values, it is possible to test weights in conformity with OIML Recommendation R111.
The values indicated in the specifications are nominal values that deviate for each individual instrument. It is therefore important that the serial number indicated in the calibration certificate is the same as the serial number on the susceptometer.

A detailed discussion of the possible calibration sequences and calculation of the uncertainty can be found in section [3].

Traceable measurements require the vertical distances to be redetermined using one or more traceable susceptibility standards. In reference [3], various methods are described for determining the vertical distances. Prior to shipment of the susceptometer, the vertical distances were determined by Sartorius using what is known as the cathetometer method (method a) in [3]). Method c) in reference [3] requires susceptibility standards to be used and is supported by Sartorius susceptometer software. In this method, a measurement is performed at the same time as a normal test of a sample. However, the distance is determined from the known susceptibility of the standard.

To calibrate the distances for the five vertical positions Z1 through Z5, a separate measurement must be conducted for each position. To start a calibration procedure for one of the vertical positions, access the calibration program for Zi in the calibration menu.

Next, select the position to be calibrated and enter the known susceptibility. Once the actual measurement has been completed, a new value for the distance Zi is determined and you will be prompted as to whether this value should be accepted. If the new value is accepted, a calibration record will be generated. This completes calibration of the selected vertical position. If you do not accept the determined vertical distance, the previous value will continue to be used.

The susceptibility of the standard being used must be in agreement with the vertical height that is being calibrated. On the one hand, for example, this means that the readings for m1 and m2 should be greater than 100 digital digits to ensure that the relative uncertainty caused by the readability is less than 1%. On the other hand, if the readings for m1 and m2 are too great, you can no longer be sure that the underlying theoretical requirements for linearity and homogeneity of the susceptibility are still valid for the standard being used. Below is an example of a range that makes practical sense for the readings m1 and m2 on the YSZ02C susceptometer (1 µg readability):

$0.000100\ g < m1/m2 < 0.010000\ g$

The indicated range also depends on the uncertainty to be achieved and the susceptibility value. Of course different standards can be used to calibrate the various vertical positions. It is recommended that the field strengths used for calibration of the susceptibility standard be about the same as the field strengths corresponding to the vertical distance level on the susceptometer.

Menu Settings

Purpose
Menu settings allow you to configure the mass comparator. In other words, you can adapt it to your requirements by selecting preset parameters from a menu.

Functions of the keys when setting parameters:
To access preset parameters:
switch the mass comparator off and then on again using the (I/⏻) key.
While all segments are displayed, briefly press the (TARE) key.

To scroll upward :
press the (CAL) key
To scroll to the right →:
press the (F1) key
To confirm a setting:
press the (TARE) key
To store the setting and exit the menu:
hold down the (TARE) key

● **Press the parameter settings key**
– If the 3rd menu level is displayed (lowest parameter; also see the next page for more information): hold down the (F1) key.

> Printout (Example)
`Menu 7 1 1`

– If the 2nd menu level is displayed: hold down the (F1) key.

> Printout (Example)
`Menu 7 1 1`
`Menu 7 2 1`
`Menu 7 3 1`

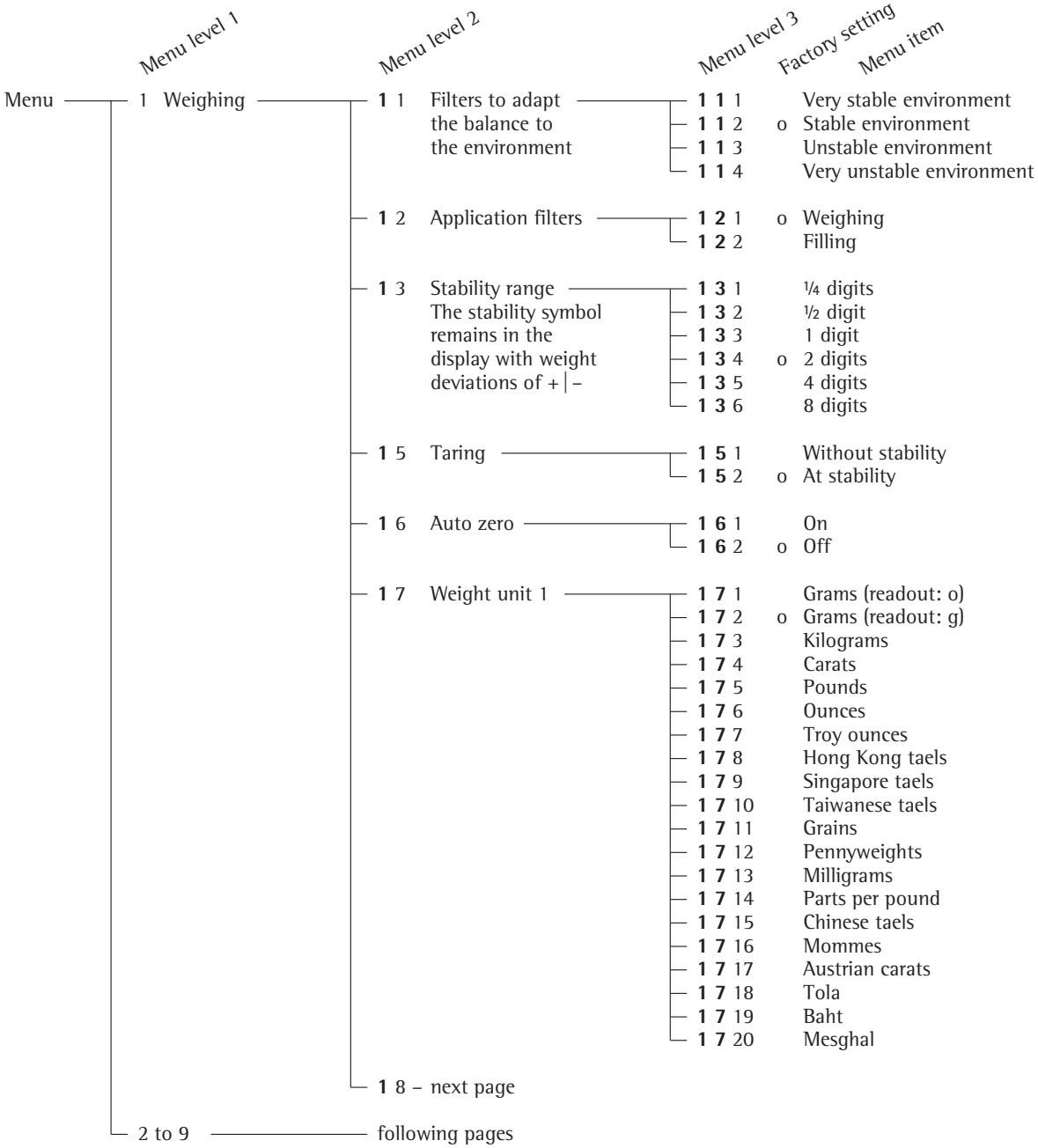
– If the 1st menu level (highest level) is displayed, all current menu settings will be printed:
hold down the (F1) key.

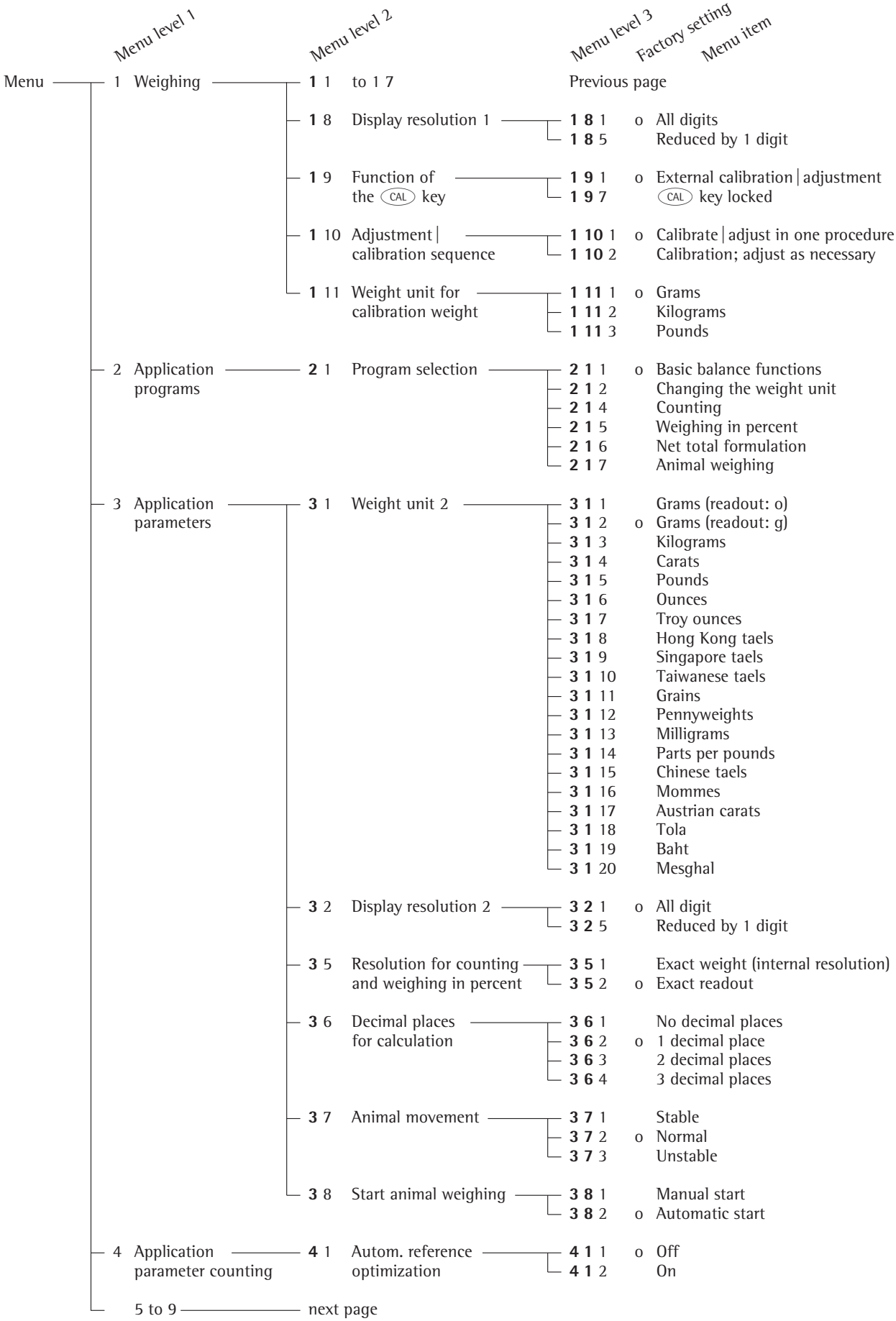
> All current menu settings of the mass comparator will be printed.

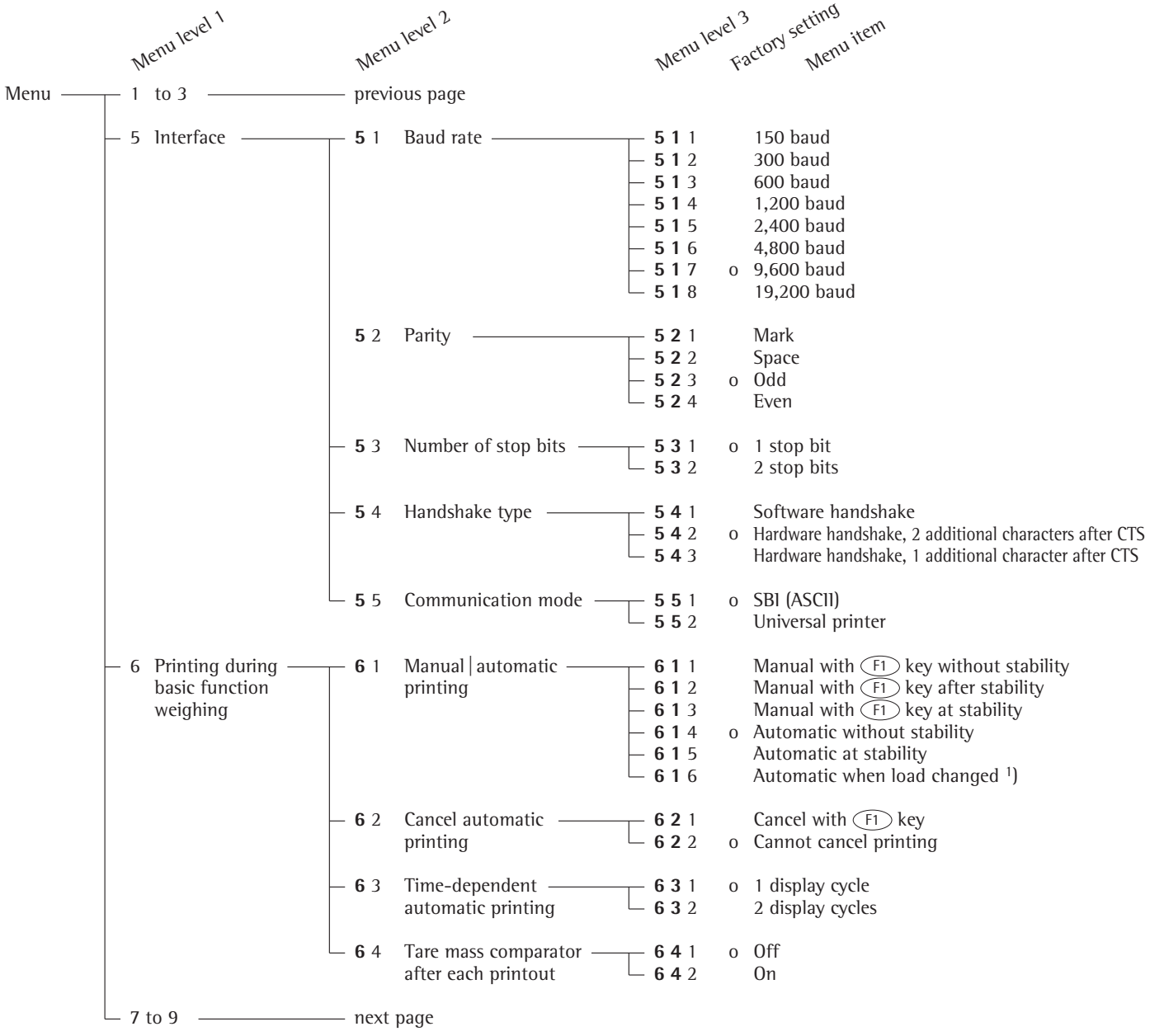
Setting the Parameters (Menu)
Example: Adapting the susceptometer to a “very unstable environment” at the weighing location (select code 114).

Step	Press	Readout
1. Switch off the susceptometer.	I/⏻	
2. Switch on the susceptometer and	I/⏻	
while all segments are displayed	TARE briefly	1
○ Scroll upward within a menu level; Following the last menu item the first menu item is displayed again.	CAL several times	2 59 1
3. Select menu level 2 (scroll to the right).	F1	11
4. Select menu level 3 (scroll to the right).	F1	112 o
5. Menu level 3: Scroll upward to select the menu item.	CAL several times	114
6. Confirm change to settings; “o” indicates the menu item that has been set.	TARE	114 o
○ Return to the menu level above (from the 3rd menu level).	F1	1
○ If necessary, set further menu items.	F1 , CAL	
7. Store parameter settings and exit menu or	TARE for 2 seconds	
○ Exit parameter settings without saving.	I/⏻	
> Restart application		0.000000 g

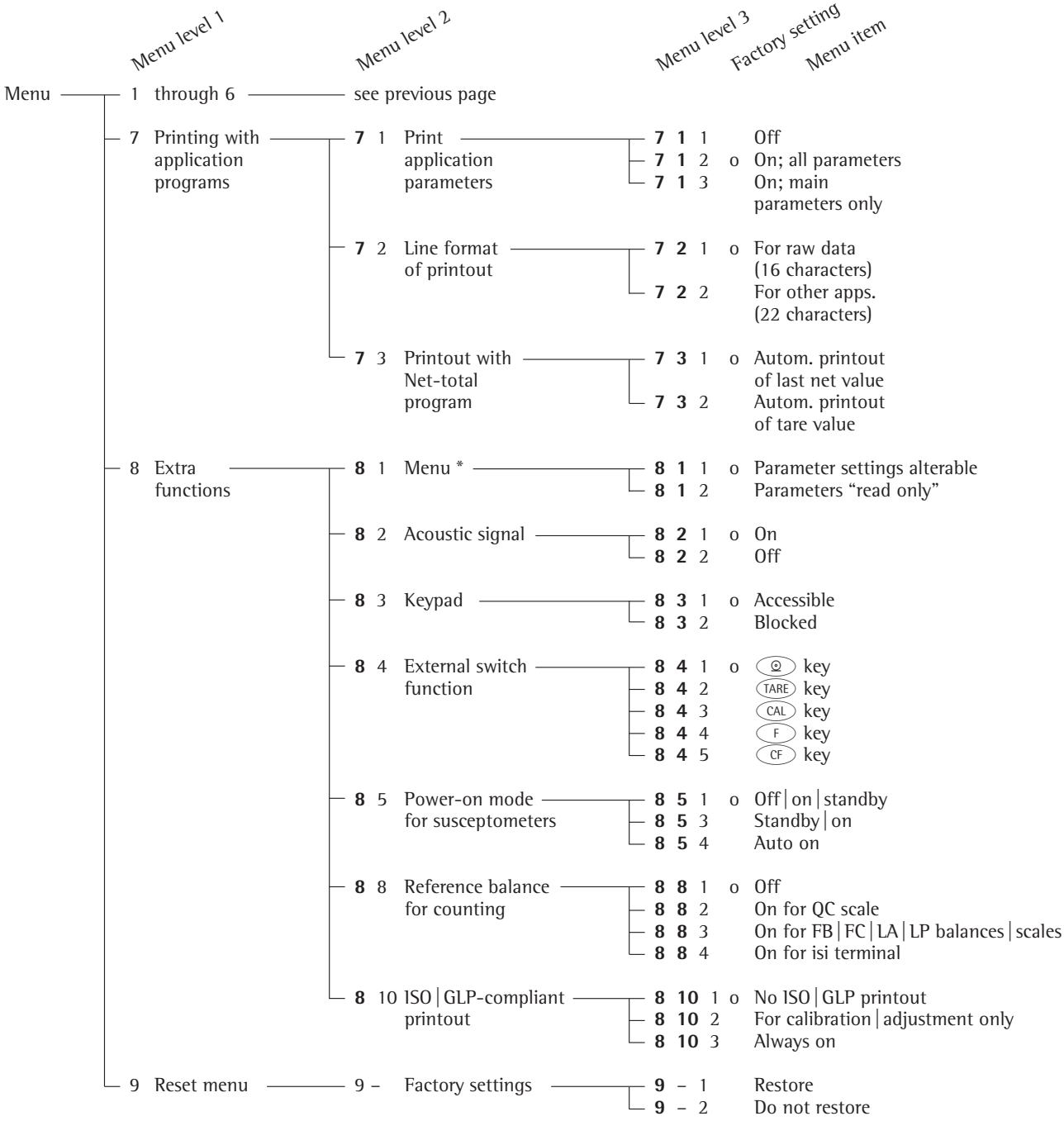
Parameter Settings (Overview)
o Factory setting
√ User-defined setting




Menu level 1
Menu level 2
Menu level 3
Factory setting
Menu item
Menu
1 Weighing
1 1 to 1 7
Previous page
1 8 Display resolution 1
1 8 1 o All digits
1 8 5 Reduced by 1 digit
1 9 Function of the CAL key
1 9 1 o External calibration | adjustment
1 9 7 CAL key locked
1 10 Adjustment | calibration sequence
1 10 1 o Calibrate | adjust in one procedure
1 10 2 Calibration; adjust as necessary
1 11 Weight unit for calibration weight
1 11 1 o Grams
1 11 2 Kilograms
1 11 3 Pounds
2 Application programs
2 1 Program selection
2 1 1 o Basic balance functions
2 1 2 Changing the weight unit
2 1 4 Counting
2 1 5 Weighing in percent
2 1 6 Net total formulation
2 1 7 Animal weighing
3 Application parameters
3 1 Weight unit 2
3 1 1 Grams (readout: o)
3 1 2 o Grams (readout: g)
3 1 3 Kilograms
3 1 4 Carats
3 1 5 Pounds
3 1 6 Ounces
3 1 7 Troy ounces
3 1 8 Hong Kong taels
3 1 9 Singapore taels
3 1 10 Taiwanese taels
3 1 11 Grains
3 1 12 Pennyweights
3 1 13 Milligrams
3 1 14 Parts per pounds
3 1 15 Chinese taels
3 1 16 Mommes
3 1 17 Austrian carats
3 1 18 Tola
3 1 19 Baht
3 1 20 Mesghal
3 2 Display resolution 2
3 2 1 o All digit
3 2 5 Reduced by 1 digit
3 5 Resolution for counting and weighing in percent
3 5 1 Exact weight (internal resolution)
3 5 2 o Exact readout
3 6 Decimal places for calculation
3 6 1 No decimal places
3 6 2 o 1 decimal place
3 6 3 2 decimal places
3 6 4 3 decimal places
3 7 Animal movement
3 7 1 Stable
3 7 2 o Normal
3 7 3 Unstable
3 8 Start animal weighing
3 8 1 Manual start
3 8 2 o Automatic start
4 Application parameter counting
4 1 Autom. reference optimization
4 1 1 o Off
4 1 2 On
5 to 9
next page



1) = Automatic printout if change in load > 10 d and at stability: unlocks at < 5 d



*= Setting cannot be changed on verified equipment

Data Interface

Purpose
The mass comparator is equipped with a data interface to which a PC (or other peripheral) can be connected.
Via a PC, you can change, start or monitor susceptometer and application program functions.

Features
Type of interface: Serial
Interface mode: Full duplex
Level: RS 232
Transmission speeds:
150, 300, 600, 1,200, 2,400, 4,800, 9,600 und 19,200 baud
Parity: Mark, space,
odd, even
Character transmission:
Start bit, 7-bit ASCII, parity,
1 or 2 stop bits
Handshake:
On a 2-wire interface:
Software (XON | XOFF)
On a 4-wire interface:
Hardware (CTS | DTR)
Operating mode: SBI
Susceptometer output format:
16 character or 22 character

Factory-set Parameters

Transmission speed:
9,600 baud (517)
Parity: Odd (523)
Stop bits: 1 stop bit (531)
Handshake: Hardware handshake,
2 characters after CTS (542)
Type of communication: Standard SBI (551)
Manual print mode: Automatic without stability (614)
Balance output format:
16 character (721)

Preparation
- Please see the sections entitled “Pin Assignment” and “Pin Assignment Chart”

Output format with 16 characters

Characters not visible in the display are output as spaces.

Possible characters depend on the output position:

Normal operation

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	+				D	D	D	D	D	D	*	U	U	U	CR	LF
or	–		.	.	.	.	.	.	.	.		*	*	*		
or	*		*	*	*	*	*	*	*	*						

*: Space
D: Character in display
U: Character for weight unit
CR: Carriage return
LF: Line feed

Special operation

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
					*	*	*	*	*	*	*	*	*	*	CR	LF
or							H	*								
or							L	*								
or							C	*								

*: Space
C: Adjust
H: Overload
L: Load too light

Error messages

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
				E	r	r	*	#	#	#	*	*	*	*	CR	LF

*: Space
#: Error number

Example: Ouput of the weight + 123.56 g

Position	1	2	3	4	5	6	7	8	9	0	1	2	3	4		
	+				1	2	3	.	5	6		g			CR	LF
	+			1	2	3	.	5	[	6	]	g			CR	LF
	+			1	2	3	.	[	5	6	]	g			CR	LF

Position 1: +, – or space
Position 2: Space
Position 3–10: Weight with decimal point; leading zeros are output as spaces
Position 11: Space
Positions 12–14: Character for weight unit or space
Position 15: Carriage return
Position 16: Line feed

Output format with 22 characters

Here, the 16-character output format is preceded by a block of 6 characters.
These 6 characters denote the value that follows.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
l	l	l	l	l	l	+	*	D	D	D	D	D	D	D	D	*	U	U	U	CR	LF
	*	*	*	*	*	–		.	.	.	.	.	.	.	.		*	*	*		
						*		*	*	*	*	*	*	*	*						

l: Character for ID
*: Space
D: Character in display
U: Character for weight unit
CR: Carriage return
LF: Line feed

Example:

1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0		
N						+				1	2	3	.	5	6		g			CR	LF
N						+			1	2	3	.	5	[	6	]	g			CR	LF
N						+			1	2	3	.	[	5	6	]	g			CR	LF

Special operation

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S	t	a	t	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	CR	LF
												H	*								
												L	*								

*: Space

H: Overload
L: Load too light

Error message

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S	t	a	t	*	*	*	*	*	E	r	r	*	#	#	#	*	*	*	*	CR	LF

*: Space

#: Error number

Character for ID 1	Meaning
Stat	Status
T1	Tare T1
N	Net N
N1	Net N1
COMPxx	Net total: Components xx
T COMP	Net total: Sum of the initial weight
Qnt	Counting: Number of pieces
wRef	Counting: Reference weight
nRef	Counting: Reference piece count
Prc	Weighing in percent: Percentage
Wxx%	Weighing in percent: Reference weight in percent
pRef	Weighing in percent: Reference percentage
mDef	Animal weighing: Target weight
x–Net	Animal weighing: Result of averaging

Data Ouptut Format

The PC connected via the data interface can send commands to the mass comparator to initiate functions of the susceptometer and application programs.
These commands are control commands and can have different formats. Control commands consist of up to 13 characters, and each character must be sent in accordance with the menu settings for data transmission.

Format for control commands

Format 1:	Esc	!	CR	LF		
Format 2:	Esc	!	#	_	CR	LF

Esc: Escape
!: Command character
CR: Carriage return (optional)
LF: Line feed (optional)

Command characters	Format 1: ! Meaning
K	Weighing mode 1 (location: very stable)
L	Weighing mode 2 (location: stable)
M	Weighing mode 3 (location: unstable)
N	Weighing mode 4 (location: very unstable)
O	Lock keypad
P	(F1) key (print, initiate and stop automatic printing)
R	Unlock keypad
S	Restart | self test
T	(TARE) key
Z	Peform internal adjustment *

Command characters	Format 2: !# Meaning
f0	Function key (F)
f1	Function key (CAL)
s3	(CF) key
x0	Perform internal calibration *
x1	Output model type
x2	Ouput serial number

* = Only on mass comparators with internal weight switching mechanisms

Synchronization
Data are exchanged between the mass comparator and PC by telegrams of ASCII code transmitted via the data interface. To ensure error-free data exchange, the parameters for baud rate, parity, handshake and character format must be in agreement.

The mass comparator can be adapted accordingly via the settings in the operating menu. In addition to these settings, data output by the mass comparator can be made dependent on various conditions, which are described in the respective application programs.

An open data interface (without connected peripherals) will not result in error messages.

Handshake
The SBI (Sartorius Balance Interface) data interface on the mass comparator features transmission and reception buffers.
In the operating menu of the mass comparator, various types of handshake can be set:

- Hardware handshake (CTS | DTR)
- Software handshake (XON, XOFF)

Hardware handshake
On a hardware handshake with a 4-wire interface, 1 additional character can be sent after CTS.

Software Handshake
The software handshake is controlled via XON and XOFF. When the unit is switched on, XON must be transmitted to enable equipment that might be connected.

Data Ouput following Print Command

The print command can be initiated by pressing the (F1) key or by sending a software command (Esc P).

Automatic Data Output

In the “automatic printout” mode, data are output to the data interface without an additional print command being given. Data can be output automatically in sync with the display at definable intervals with or without stability of the mass comparator. The time of the interval depends on the settings under “Filter” (code 1 1 x) and “Time-dependent autom. printing” (Code 6 3 x).

If the automatic data output option has been selected in the operating menu, data will be output immediately after the mass comparator has been switched on. In the setup menu, you can define whether automatic data output can be stopped and started with the (F1) key.

Higher Data Output Rates for Weights

If you require weight output rates higher than 10 Hz, please contact Sartorius directly for more information.

Pin Assignment Chart

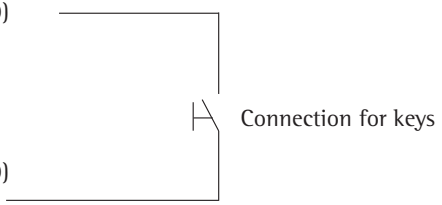
Female interface connector:
25-position D-submini DB25S with screw connection

Required male connector (recommended)**:**
25-pin D-submini DB25S with integrated shield cap and shield plate
(amp type 826 985-1C) and locking screws (amp type 164 868-1)

⚠ **Be careful if you are connecting equipment using ready-made RS-232 interface cables:**
RS-232 cables from other manufacturers often have pin assignments that are not approved for use with Sartorius equipment. Therefore, please review the respective connection diagrams before connecting equipment and disconnect wires that are not assigned in accordance with Sartorius-approved connection diagrams (e.g., pin 6).
Unauthorized wiring can lead to functional errors or destruction of the mass comparator or connected peripheral equipment.

Pin assignment:

Pin 1: System ground (earth)
Pin 2: Data output (TxD)
Pin 3: Data input (RxD)
Pin 4: Internal mass (GND)
Pin 5: Clear to send (CTS)
Pin 6: Internally assigned
Pin 7: Internal mass (GND)
Pin 8: Internal mass (GND)
Pin 9: Reset in *)
Pin 10: Not assigned
Pin 11: + 12 V
Pin 12: Reset out *)
Pin 13: + 5 V
Pin 14: Internal mass (GND)
Pin 15: Universal key
Pin 16: Not assigned
Pin 17: Not assigned
Pin 18: Not assigned
Pin 19: Not assigned
Pin 20: Data terminal ready (DTR)
Pin 21: Mass input for external power supply
Pin 22: Not assigned
Pin 23: Not assigned
Pin 24: External power supply input + 12 ... 30 V
Pin 25: + 5 V

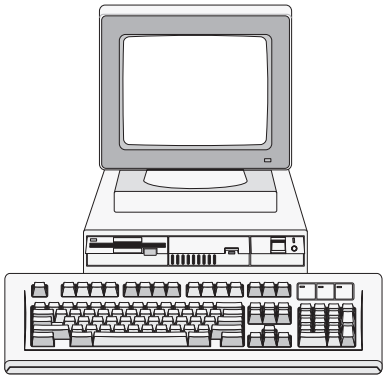


*) = Hardware restart

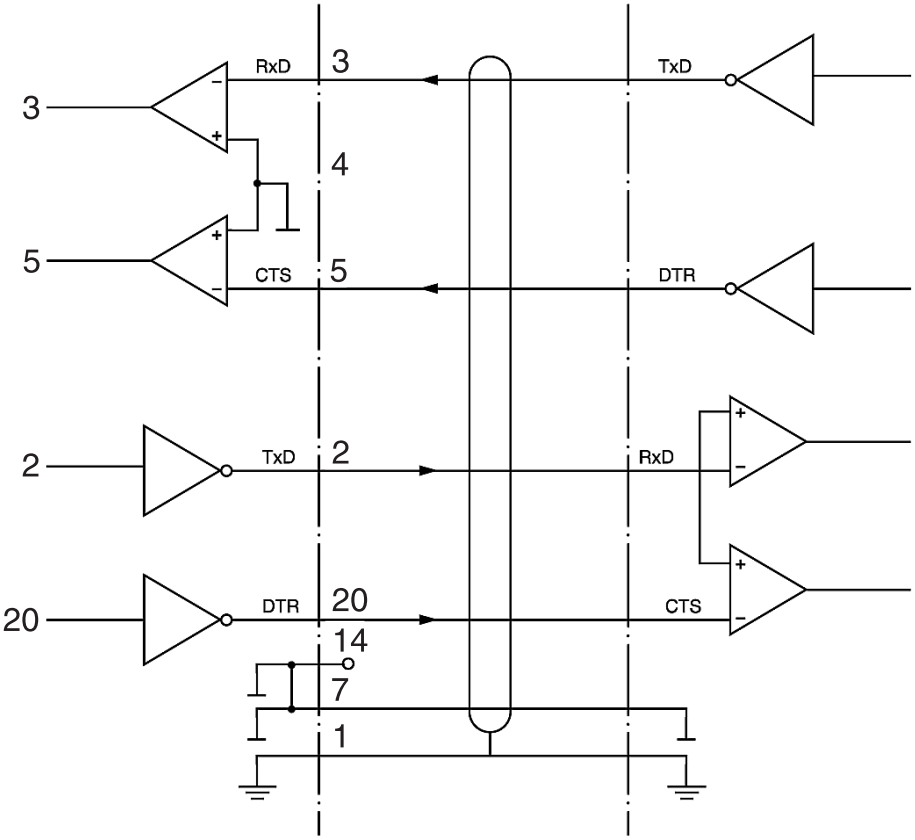
Connection Diagram

– For connecting a PC or peripheral device to the mass comparator in accordance with standard RS-232C | V24 for transmission cables up to 15 m in length.

V24



Mass comparator



Peripheral		
PC 25 pin	**or**	**PC 9 pin**
2		3
20		4
3		2
5		8
6		6
7		5

Cable type in accordance with AWG 24

Error Messages

Error messages are shown on the display for approx. 2 seconds. Afterwards, the program automatically returns to the weighing mode.

Display	Cause	Solution
No display segments appear	No power supply	Check power supply
	AC adapter not plugged in	Plug in AC adapter
H	Capacity exceeded	Remove sample from the loading platform
L or Err 54	Loading platform is touching nearby object	Loading platform may not touch surrounding parts
Err 01	Data output does not coincide with output format	Choose the correct setting in the menu
Err 02	Adjustment condition was not maintained, e.g.: – Unit tared with (TARE) key – Sample on loading platform	Do not adjust until zero has been displayed Unload the mass comparator
Err 10	(TARE) key is locked if the second tare memory is full (net total); tare functions are interlocked	The tare key can be pressed again only after the 2nd tare memory has been cleared with the (CF) key
Err 11	Tare values cannot be stored	Press the (TARE) key
Err 22	Weight is too low or sample not placed on the weighing pan during application programs	Increase the weight
Err 30	Data interface locked for print output	Reset menu or contact Sartorius customer support
Err 235	Cable not properly connected Electronics box switched with another balance	Insert the connector correctly Connect equipment parts that belong together
Weight constantly changes	Unstable location (too much vibration or a draft in room)	Move to a different location Adapt the mass comparator via the setup menu
	Magnetic disturbances	
	Foreign object between the loading platform and housing	Remove foreign object

If other errors occur, please contact Sartorius customer support.

Address:
Visit our website at http://www.sartorius.com

Care and Maintenance

Service
Regular servicing by a Sartorius technician will ensure the continued weighing accuracy of your mass comparator. Sartorius can offer you service contracts with your choice of regular service intervals ranging from 1 month to 2 years.
The frequency of the service interval depends on the operating conditions and tolerance requirements.

Repairs
Only service technicians authorized by Sartorius are allowed to repair the equipment. Unauthorized repairs can lead to unsafe or hazardous conditions for the operator of the equipment.

Cleaning
- Before cleaning the mass comparator, unplug the AC adapter from the wall outlet. If necessary, disconnect the interface cable.
- Use a cloth that has been wet with a mild detergent (soap) to clean the mass comparator.
- After cleaning, wipe down the mass comparator with a soft, dry cloth.

⚠ Make sure that no liquid enters the mass comparator housing.

⚠ Please do not use any aggressive cleaning agents (solvents or similar agents).

Cleaning Aluminum Surfaces
As a general rule, clean all aluminum parts of the unit at regular intervals. Thoroughly clean the aluminum loading plate separately. Use a damp cloth or sponge to clean the aluminum parts of the mass comparator, and please ensure that you only use a commercially available household cleaner that is safe for aluminum. Simply wipe the aluminum surfaces of the unit with a cloth and then thoroughly rinse them until all residue has been removed. After cleaning, allow the unit to dry.

Do not use any solvents to clean the equipment.

Safety Inspection
If there is any indication that safe operation of the mass comparator with the AC adapter is no longer warranted, turn off the power and disconnect the equipment from AC power immediately.
> Lock the equipment in a secure place to ensure that it cannot be used for the time being.

In this case, notify your nearest Sartorius Service Center. Only service technicians who are authorized by Sartorius are allowed to perform maintenance and repair work on the equipment.

We recommend that an authorized technician check the following on a regular basis:
- Insulating resistance of >7 Mohms with direct voltage of at least 500 V at a 500 kohm load
- Substitute leakage current of < 0.05 mA measured with a properly calibrated multimeter

Disposal

The packaging consists of environmentally friendly materials that can serve as secondary raw materials. If the packaging is no longer required, it can be disposed of in Germany at no charge via the dual system of the company VfW (contract number D-59101-2009-1129). Otherwise, dispose of the material according to the applicable local regulations for waste disposal. The device, including accessories and batteries, should not be disposed of as household waste. It should instead be recycled as for electrical and electronic devices. For more information regarding disposal and recycling, please contact our local service representatives. In addition, the partners listed on the following website are available to assist you within the EU:

1) Go to http://www.sartorius.com.
2) In the menu bar, select “Service.”
3) Then select “Disposal Information.”
4) The addresses of the local Sartorius disposal contact persons can be found in the PDF files listed on this page.

Sartorius will not take back equipment contaminated with hazardous materials (ABC contamination) – either for repair or disposal.

Detailed information with service addresses for returning your device for repair or disposal can be found on our website (www.sartorius.com) or requested from a Sartorius Service Center.

Specifications

Base of the unit:	338×286 mm
Height of the unit:	249 mm
Maximum load:	50 kg
Magnetic moment of the test magnet:	m~0.1Am, ideal geometry: h/d=0.87
Distance levels above the loading platform:	Z1, Z2, Z3, Z4, Z5 18|20|27|35|43 mm (nominal)
Field strength A/m in distance levels:	2700, 2000, 800, 400, 200
Weighing system resolution:	YSZ01C 10 µg YSZ02C 1 µg
Magnet turning apparatus:	Adjustable using knob on side of unit, N-S indicator (red up indicates North pole up)
Software:	User-friendly PC software with on-screen prompts for operator guidance, decision templates, and capability of setting short programs
Protocol:	Protocol transfer capability to more advanced measurement programs

Literature

[1] Richard S. Davis, Determining the Magnetic Properties of 1 kg Mass Standard, J. Res. Natl. Inst. Stand. Technol. 100 (1995), p. 209-225

[2] Draft revision of International Recommendation OIML R 111, Part 1: Metrological and Technical Requirements

[3] Chung, J.W., Ryu, K.S., Davis, R.S., Uncertainty analysis of the BIPM susceptometer, Metrologia 38 (2001), 535-541

Measuring Ranges

Recommended use of the susceptometer in accordance with OIML R111 and maximum allowable susceptibility χ

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

Change of the susceptibility for 1 digit $\Delta\chi$ (1d)

Nominal weight	Readability 10 µg	1 µg
50 kg	0.00005	0.000005
20 kg	0.00006	0.000006
10 kg	0.00006	0.000006
5 kg	0.00006	0.000006
2 kg	0.00006	0.000006
1 kg	0.00006	0.000006
500 g	0.00006	0.000006
200 g	0.00008	0.000008
100 g	0.00010	0.000010
50 g	0.00012	0.000012
20 g	0.00020	0.000020
10 g	0.00031	0.000031
5 g	0.00047	0.000047
2 g	0.00084	0.000084

Measuring range of the Sartorius susceptometer

Nominal weight	Readability 10 µg	1 µg
50 kg	0.003...1	0.0003...1
20 kg	0.003...1	0.0003...1
10 kg	0.003...1	0.0003...1
5 kg	0.003...1	0.0003...1
2 kg	0.003...1	0.0003...1
1 kg	0.003...1	0.0003...1
500 g	0.003...1	0.0003...1
200 g	0.004...1	0.0004...1
100 g	0.005...1	0.0005...1
50 g	0.006...1	0.0006...1
20 g	0.010...1	0.0010...1
10 g	0.016...1	0.0016...1
5 g	0.024...1	0.0024...1
2 g	0.042...1	0.0042...1

Recommended use of the susceptometer in accordance with OIML R111 and maximum allowable magnetization $\mu_0 M_z$ in µT

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

Change of the magnetization for 1 digit $\mu_0 \Delta M_z$ Δ (1d)

Nominal weight	Readability 10 µg	1 µg
50 kg	0.2 µT	0.02 µT
20 kg	0.1 µT	0.01 µT
10 kg	0.1 µT	0.01 µT
5 kg	0.1 µT	0.01 µT
2 kg	0.1 µT	0.01 µT
1 kg	0.1 µT	0.01 µT
500 g	0.1 µT	0.01 µT
200 g	0.1 µT	0.01 µT
100 g	0.2 µT	0.01 µT
50 g	0.2 µT	0.02 µT
20 g	0.4 µT	0.04 µT
10 g	0.6 µT	0.06 µT
5 g	0.9 µT	0.09 µT
2 g	1.8 µT	0.18 µT

Measuring range Sartorius susceptometer

Nominal weight	Readability 10 µg	1 µg
50 kg	10 µT...1 mT	1.0 µT...1 mT
20 kg	7 µT...1 mT	0.7 µT...1 mT
10 kg	6 µT...1 mT	0.6 µT...1 mT
5 kg	5 µT...1 mT	0.5 µT...1 mT
2 kg	5 µT...1 mT	0.5 µT...1 mT
1 kg	5 µT...1 mT	0.5 µT...1 mT
500 g	5 µT...1 mT	0.5 µT...1 mT
200 g	6 µT...1 mT	0.6 µT...1 mT
100 g	8 µT...1 mT	0.8 µT...1 mT
50 g	11 µT...1 mT	1.1 µT...1 mT
20 g	18 µT...1 mT	1.8 µT...1 mT
10 g	30 µT...1 mT	3.0 µT...1 mT
5 g	47 µT...1 mT	4.7 µT...1 mT
2 g	90 µT...1 mT	9.0 µT...1 mT

Accessories (Options)

Item	Order no.
Calibration set (consists of 3 test magnets and a spacer for determining the dipole moment of the test magnet)	**YSZ01RMC**
Reference	**YSZ01RSC**
Susceptibility standard	**Available upon request**
Calibration weight, 10 g (accuracy class E2)	**YCW412-00**
Interface cable	
– for connection to a PC, 25-pin	**7357312**
– for connection to a PC, 9-pin	**7357314**
Adapter cable from 25-pin D-submini to 9-pos. D-submini, Length 0.25 m	**6965619**

Declaration of Conformity to Council Directives 89/336/EEC and 73/23/EEC

The electronic Susceptometer
YSZ 01C/02C

meets the requirements of the test standards listed below, in conjunction with the associated power supplies, auxiliary peripheral devices and installation equipment listed in Annex A2 (see Annex A1for a technical description).

1. Electromagnetic Compatibility
1.1 Source for 89/336/EEC: EC Official Journal, No. 2002/C62/02

EN 61326-1 Electrical equipment for measurement, control and laboratory use– EMC requirements
Part 1: General requirements

Limitation of emissions: Residential areas, Class B
Defined immunity to interference: Industrial areas, continuous unmonitored operation

2. Safety of Electrical Equipment
2.1 Source for 73/23/EEC: EC Official Journal, No. 2001/C106/03

EN 61010 Safety requirements for electrical equipment for measurement, control and laboratory use
Part 1: General requirements
EN 60950 Safety of information technology equipment

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