

Lab Manager 2018

BALANCES RESOURCE GUIDE



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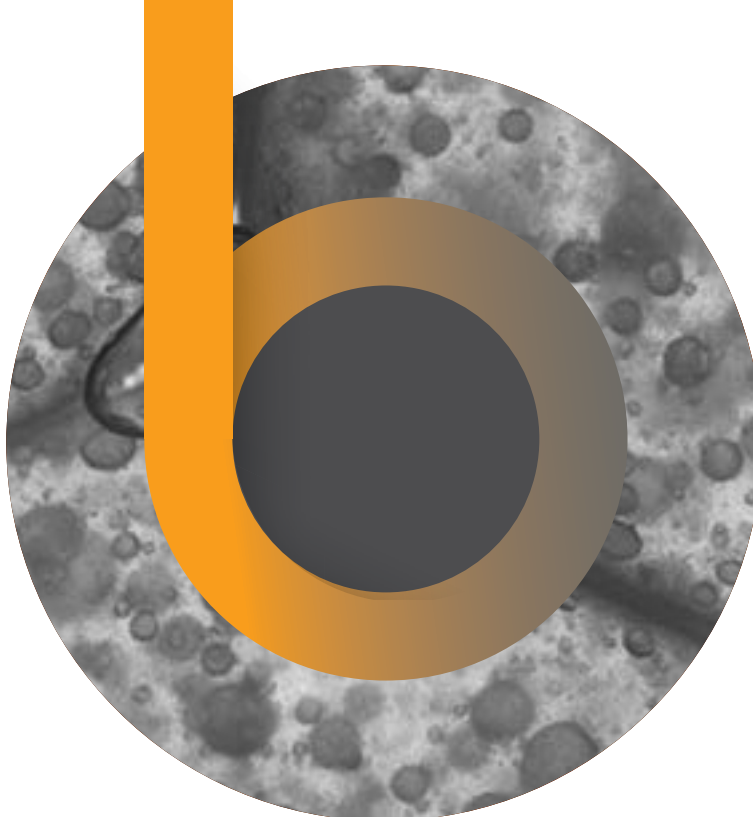
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Introduction

by Lab Manager

Laboratory balances are used in virtually every scientific environment to measure an object's mass to a very high degree of precision. The history of balances dates back to Ancient Egypt, where a simple equal arm balance on a fulcrum that compared two masses was standard. Today, balances have become much more sophisticated and have a multitude of uses. Like many other instrument types, balances have come to rely heavily on electronics. Compensating physical weights were replaced long ago by strain gauges and frequency-modulated force measurement in low-end balances, and by electromagnetic force compensation in higher-end analytical instruments. Modern laboratories also have numerous weighing options, including sliding-scale mechanical balances, top loaders, and analytical balances.

Overview of Balance Types

by Trevor Henderson, PhD



Precision Balances

Precision balances offer the widest range of capacity, often in the range of 5 to 7 Kg, and have readability typically between 1 mg (0.001 g) and 1 g. These balances are efficient for tasks including formulation, density determination, quality control, and materials testing.

Analytical Balances

With the second widest range of weighing capacity, analytical balances are a staple of many labs requiring accurate mass in the sub-milligram range. Such balances typically have a balance pan located inside a draft shield so that air currents do not affect the balance's operation. Analytical balances typically have a readability of 0.1 mg or better.

Semi-microbalances

Semi-micro balances are specifically designed for applications that require accuracy to the hundred-thousandth of a gram. Semi-micro balances bridge the gap between analytical and microbalances, offering increased accuracy while still accommodating larger sample sizes.

Microbalances

Capable of making precise measurements of the mass of objects on the order of a millionth of a gram, microbalances normally have a maximum capacity of approximately 50 g. Microbalances meet extremely high accuracy requirements, such as those required by the pharmaceutical industry for analytical tests and assays.

Ultra-microbalances

Ultra-microbalances offer extremely precise results with a readability down to 0.1 ug (0.0000001 g). These balances are used with maximum accuracy is required, even for minimal sample quantities.

Questions to Ask When Buying a Balance

by Ryan Ackerman



What type of sample am I weighing?

Different sample types will have an effect on the type of balance setup used. If the samples are powder-based, then a draft shield will be needed. As well, weighing liquid into test tubes may require a tare holder to hold the tube up. The surface area of the sample also may affect which type of plate the sample is weighed upon. Being aware of your sample type will help alleviate many of the issues associated with choosing the correct balance configuration.

What is my nominal sample weight?

Knowing what your nominal sample weight is can help take a lot of the legwork out of buying a balance. Buying a balance with a lower capacity will typically allow for more precise readings. However, reading too close to the upper limit can damage a balance or throw off the calibration. Many different types of balances with different readability ranges exist, from the highest end with precision balances that can typically read from 1 mg to 70 000 g, all the way down to laboratory ultra-microbalances which can typically read from 0.1 µg to 5 g.

What type of laboratory environment will I be weighing in?

Balances are highly sensitive pieces of lab equipment. Many considerations need to be taken into account when setting up the balance. If the lab is in an area prone to vibration, such

as next to a roadway, then a vibration-proof table should be installed. If the area has a lot of air circulation, then a draft shield should be set up, especially for powder samples. For dry environments with a lot of static electricity, an ioniser can be installed to help control this. For very sensitive ultra-microbalances, even changing between floors may require a recalibration due to the effect of gravity on the scale.

How do I look after my balance?

The most important thing in looking after your lab balance is to keep it clean and calibrated. In general, most facilities should service and calibrate their balances on an annual basis, but that frequency depends on how often you use your balance, the working environment, and any other regulatory mandates for your industry. Some labs may need to calibrate their balances monthly or even daily.

How to Maintain Your Balance

by Rachel Muenz



When it comes to balance maintenance, users should follow any specific manufacturer's recommendations that come with the balance. The user's manual is a great place to start as it outlines all of the proper maintenance tasks for that specific balance. Arguably, the most important task to remember is to keep the balance clean and calibrated.

As for how frequent maintenance should be, in general, it is recommended that facilities service and calibrate their balances on an annual basis. However, this is also dependent upon how often you use your balance, the working environment, and any other regulatory mandates for your industry. Some facilities may need to have routine calibration conducted more frequently, such as monthly or even daily. As a rule of thumb, any time the balance is not performing as it did when the lab first began using it, users should contact their local service provider to have it checked out.

Most manufacturers recommend calibrating a brand-new balance before using it, as the simple process of shipping can affect the mechanics of the balance. Frequent calibration ensures consistent results and maximizes precision in your measurements. If you notice your balance is delivering readings that are inconsistent or less repeatable, it's definitely time for calibration.

If a user's lab experiences frequent temperature or barometric changes, they will need to calibrate their

EXPERT TIPS: SAFEGUARDING YOUR BALANCE

- Use the appropriate cleaning agents to routinely clean your balance. Some agents can significantly damage balance surfaces, so be sure to consult the balance's service manual before using a cleaning solvent on the balance.
- Plug your balance into a power surge protector.
- Allow the balance to warm up to room temperature levels before use.
- Do not leave items on the balance weighing pan for an extended amount of time.
- Consider purchasing an extended warranty. Most manufacturers' standard warranties cover the balance from manufacturer defects, but often repairs fall outside of that warranty.

balances more often. That's because fluctuations in barometric pressure can wreak havoc with the results from a precision or analytical balance that hasn't been calibrated. Additionally, if the location in which you're working has a different gravitational force than that of the factory producing the balance, calibration is necessary for precise measurements.

As with other lab instruments, there are plenty of mistakes users make when looking after their balances. Not using a certified technician to perform routine maintenance or not using certified weights to perform the calibration when doing it themselves are common errors. Calibration weights should be stored in the proper containers where they will remain free from dust or smudges and at the proper ambient temperatures. Calibration weights should also be handled with the proper gloves and forceps where applicable to prevent damage.

Users need to be careful when cleaning, storing, and moving their balances, as applying more pressure or weight to the

pan than it can handle can cause damage. It's best to remove the pan when cleaning or storing your balance; otherwise, you might accidentally set something on top of it, and then wonder why it's not working.

Simply forgetting to calibrate your balance is another mistake that can lead to large issues, but is easily solved by keeping a log to record maintenance tasks. A maintenance log is beneficial, especially if there are multiple users operating the balance. Also, if you need professional repairs done, it's helpful for the technicians to know exactly what you've done and when you did it. Apart from the user's manual, calling the manufacturer for maintenance tips or to help solve any issues you have is a good resource in caring for your balance. Overall, just remembering to do maintenance and being gentle are the keys to a happy balance.

Tips for Analytical Balance Users

by Erica Tennenhouse, PhD



- Place a discharge ionizer next to your balance to prevent electrostatic charge from distorting weighing results.
- Keep the door shut to isolate the weighing pan from the lab environment.
- Avoid touching the sample pan with bare hands by wearing gloves.

Analytical balances represent the most accurate weighing standard for general use. These devices also excel at quantifying changes in mass as a result of certain processes such as evaporation. In addition to purchasing a high-quality analytical balance, it is essential to use and maintain your analytical balance correctly. Here are some best practices that analytical balance users should follow to ensure accurate weighing.

- Do not use aggressive cleaning agents.
- Clean with a mild soap, and polish with a dry cloth
- Calibrate your balance at the location where it will be used. Re-calibrate on a regular basis and any time the balance is moved.
- Operate your balance in an environment where the ambient temperature is maintained between 18 degrees C and 30 degrees C.
- Avoid vibrations by placing your balance on a stable surface in a draft-free location.
- Use a leveling bubble and adjustable foot screws to ensure your balance is completely level.

LINDA Says...

Some balances are equipped with internal motorized calibration, and while this feature might cost more, it's convenient and helpful. Since internal calibration is extremely easy, users might tend to calibrate more regularly. Most balances with internal calibration also offer external calibration, which is a fairly simple process, but requires more effort by the user.



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Product Spotlight

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Insights into ...

by Mike May, PhD and Angelo DePalma, PhD



Pipette Calibration

An effective pipette calibration begins with a standard calibration protocol and a properly calibrated balance. Do-it-yourselfers should verify that their balance is calibrated and, if following ISO standards, use traceable calibration weights and good weighing practices to assure the best possible balance accuracy. Routine manufacturer or third-party servicing is the easiest way to achieve this. Similarly, users should maintain their pipette for optimal performance through regular cleaning according to the manufacturer's recommendations.

While a good deal of leeway exists in the application of published calibration methods, generally a five-decimal-place (accurate to 0.01 mg) or better balance is all that is needed. Weighing accuracy depends on the performance expectation for the pipette. Devices that dispense low microliters or even fractions of microliters require greater calibration accuracy than do those operating in the 50-to-100-microliter range.

It is advised that pipette calibration occur not under ideal environmental conditions but under real-use conditions, using the same pipette tips that are used every day. Third-party tips may not achieve the same fill volume as the manufacturer's own (or recommended) tip. Also, when sending pipettes out, try to provide the service organization with typical conditions in your lab.

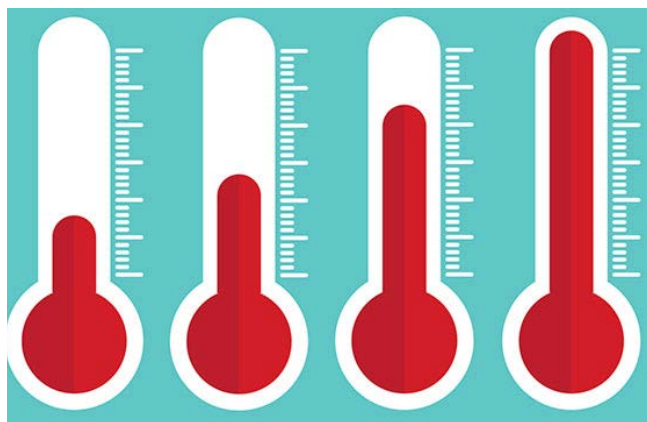


Airflow Issues

Draft and vibration can have the most significant effects on weighing quality. In most cases, a shield can keep airflow away from a sample, but not just any shield will do. Placing the shield in the path of an airflow can cool it, and that may influence the accuracy of weighing. For a balance that measures in increments of less than 0.1 milligram, the shield must be small enough to not be cooled by airflow, but large enough to block it.

Even a draft shield is not enough, especially for an analytical balance or a microbalance. When the draft shield door is open—for example, when weighing-in a sample or placing a tare vessel or weigh boat or paper—the external air ingresses and can cause turbulence in the weigh chamber. Repeatability may suffer as a result. And if there is a significant airflow in the weighing area, even a balance with a draft shield may be affected by the flow of air unsettling the body of the balance or draft shield, causing a vibration through the chassis of the balance.

If a balance is used inside a hood, the need for blocking drafts can increase because of the higher air velocity. In these situations, it can be difficult to weigh even increments of 10 milligrams without some special method of handling airflow.



Temperature Effects

Changes in temperature, humidity, and air pressure all affect balances but temperature changes are by far the most serious because they occur everywhere. Temperature effects are mostly insignificant for top-loaders but a difference of 1.5°C can cause sensitivity and zero point to shift in analytical balances. Zero point drift is trivial, thanks to automated taring, but sensitivity drift will introduce systematic error. Sensitivity drift is normally specified for a particular balance, depending on the sample weight and temperature difference. For example, a difference of 5°C will affect the observed weight of a 100 g sample by up to 1 mg.

Operators should be wary of warming or cooling of tare vessels during removal from the balance. This effect can be demonstrated by removing a beaker from the weighing pan with your bare hands. Most would expect the mass contributed by oils and sweat from the fingers would cause the weight to rise. In reality, updrafts caused by warming the beaker by a few degrees more than compensate for the added mass. Similarly, downdrafts caused by cooling cause significant apparent weight gains. Temperature difference effects apply to balance and sample, and particularly to glassware that has recently been removed from a dishwasher. It is therefore advised to allow sample, tare vessel, and balance to reach mutual temperature equilibrium whenever temperature differences are suspected.

Featured Manufacturers



Rice Lake Weighing Systems

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