



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-L102

Using Balances

Standard Operating Procedure

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1. Purpose

This procedure describes the proper use, zeroing, taring, and routine quality checks for the laboratory balances in the EA Program. Correct weighing technique is fundamental to virtually every quantitative laboratory procedure. For calibration and verification protocols, see [SOP-L200 Analytical Balance Calibration](#).

2. Scope

- **Applies to:** All Mettler Toledo balances in the EA Program laboratory, including the basic balances (MS1602TS/00) and the precision balance (XPE205 DeltaRange) (Mettler Toledo, 2015a, 2015b)
- **Does not apply to:** Portable field balances or calibration procedures (see [SOP-L200](#))
- **Location:** EA Program laboratory, SGM 133

3. Responsibilities

Role	Responsibility
Lab PI	Approve SOP, ensure training compliance
Trained Personnel	Follow this SOP, report malfunctions
New Students	Complete training before independent use

4. Definitions

- **Capacity (maximum load):** The maximum mass that can be placed on the weighing pan without risking damage to the weighing cell; exceeding the rated capacity will damage the load cell and require expensive repair; the MS1602TS capacity is 1620 g and the XPE205 capacity is 220 g / 81 g (DeltaRange) (Mettler Toledo, 2015a, 2015b).
- **Draft shield:** The glass or acrylic enclosure surrounding the weighing pan on the XPE205 precision balance; reduces air current disturbances that cause reading instability; always keep closed except when placing or removing items.
- **Drift:** Gradual, directional change in the balance reading under constant load; caused by temperature changes, vibration, or electronic instability; the balance should be allowed to warm up for at least 30 minutes before critical weighing.
- **Linearity:** The degree to which balance readings are proportional to applied mass across the full weighing range; verified during calibration per [SOP-L200](#).
- **Net weight:** The mass of sample only, after the tare weight of the container has been subtracted; what is displayed after pressing the Tare key with the container on the pan.
- **Readability (resolution):** The smallest increment the balance can display; the MS1602TS reads to 0.01 g and the XPE205 reads to 0.1 mg (0.0001 g) (Mettler Toledo, 2015a, 2015b).
- **Repeatability:** The standard deviation of repeated measurements of the same weight under identical conditions; a key short-term precision indicator; affected by vibration, draft, and sample placement position.

- **Spirit level (bubble level):** A small bubble vial mounted on the balance base; the bubble must be centered in the target circle before weighing; off-level readings can introduce systematic errors.
- **Tare:** The function that zeroes the displayed mass when a container is on the pan, so subsequent readings show only the mass of material added (Mettler Toledo, 2023).
- **Weighing cell:** The internal transducer (typically an electromagnetic force compensation cell) that converts the mechanical load on the pan to an electrical signal; the most sensitive and expensive component of the balance; protect it from impact, overloading, and corrosive chemicals.
- **Zeroing:** Setting the balance display to exactly zero with an empty pan and no load; performed at the start of each session and whenever the balance is moved; distinct from taring, which zeroes the balance with a container already on the pan.

5. Safety and Hazards

Hazards

- **Physical:** Dropping heavy items onto the balance pan can damage the weighing cell. Handle objects carefully and never exceed the rated capacity.
- **Chemical:** Some materials weighed on the balance may be hazardous. Refer to the relevant SOP for the material being weighed. Never place chemicals directly on the weighing pan; always use a sample vessel.

5.1. Required PPE

- ☐ Lab coat
- ☐ Nitrile gloves (when handling chemical samples)
- ☐ Safety glasses (when weighing chemical reagents)

5.2. Emergency Procedures

If a chemical spill occurs on or near the balance, clean the spill per [SOP-L003 Hazardous Materials Handling](#) before resuming use.

6. Equipment and Materials

6.1. EA Program Balances

Balance	Model	Capacity	Readability	Location
Precision balance (1)	XPE205	220 g / 81 g	0.1 mg	SGM 133
Basic balance (1–3)	MS1602TS	1620 g	0.01 g	SGM 133

(Mettler Toledo, 2015b, 2015a)

6.2. Weighing Supplies

Item	Notes
Weighing paper	Single use; keeps chemicals off the pan
Sample vessels	Weighing boats, crucibles, or tared containers
Forceps or tweezers	For handling calibration weights or small containers without contamination
Lint-free wipes (Kimwipes)	For cleaning the pan and draft shield
Anti-static brush	For removing powder adhering to the draft shield interior

7. Procedure

7.1. Startup and Warm-Up

Allow the balance to warm up for at least 30 minutes before making critical weighings (< 0.001 g significance) (Mettler Toledo, 2015b). This allows the internal components to reach thermal equilibrium.

7.2. Leveling the Balance

1. Check the spirit level before each use session.
2. If the bubble is not centered, adjust the leveling feet at the base of the balance.
3. For the XPE205, use the built-in leveling aid: **Balance menu** > **Leveling aid** (Mettler Toledo, 2015b).

7.3. Zeroing

1. Verify the balance is empty and the draft shield is closed.
2. Press **Zero** (or **On/Zero**). The display should read 0.000 g (for the MS1602TS) or 0.0000 g (for the XPE205).
3. If the display does not settle, check that the balance is level, no air currents are present, and the pan is clean and dry.

7.4. Taring

1. Zero the balance (§[sec-zeroing]).
2. Open the draft shield.
3. Place the sample vessel on the center of the weighing pan.
4. Close the draft shield.
5. Press the **Tare** key. The display reads zero and the **Net** indicator appears.

7.5. Performing a Weighing

1. Open the draft shield (if applicable).
2. Place the weighing object into the tared sample vessel.
3. Close the draft shield and wait for the stability indicator.
4. Record the displayed mass in the lab notebook.
5. If using the XPE205 electronic results feature, tap **Add result** to append the value to the results list.

7.6. Completing and Saving Results (XPE205)

1. Tap **Complete** to open the task completion dialog.
2. Select an option to save or print the results list.
3. Follow the on-screen instructions.
4. Tap **Complete** to finalize; the results list is saved or printed and then cleared.

7.7. Shutdown

1. Remove all samples and vessels from the weighing pan.
2. Clean the pan and draft shield interior with a lint-free wipe.
3. Close the draft shield.
4. To enter standby mode, hold the power/standby key. The display goes dark but the balance remains powered on and thermally stable.
5. To switch the balance off completely, disconnect from the power supply. Note that the balance will require a full warm-up before its next use.

8. Quality Control and Acceptance Criteria

8.1. Leveling the Balance

Exact horizontal positioning is essential for repeatable and accurate results (Mettler Toledo, 2015b):

1. Check the spirit level before each use session.
2. If the message “Balance is out of level” appears, tap **Level the balance** to open the leveling aid.
3. Adjust the leveling feet following the on-screen instructions until the bubble is centered.

8.2. Internal Adjustment (XPE205)

1. Navigate to **Methods > Adjustments**.
2. Verify that the adjustment strategy is set to **Internal adjustment**.
3. Select the adjustment and tap **Start**.
4. Do not touch the balance during the adjustment.
5. When complete, review the adjustment results.
6. Tap **Print** if a record is needed, then tap **Finish adjustment** (Mettler Toledo, 2015b).

For external calibration verification using traceable reference weights, see [SOP-L200](#).

9. Waste Disposal

No waste is generated by this procedure. Cleaning materials (Kimwipes) can be disposed of in standard trash unless they contacted hazardous chemicals, in which case follow [SOP-L003](#).

10. References

- Mettler Toledo. (2015a). *MS1602TS basic balance: Operating instructions*. <https://www.mt.com>
- Mettler Toledo. (2015b). *XPE205 DeltaRange precision balance: Operating instructions*. <https://www.mt.com>
- Mettler Toledo. (2023). *Good weighing practice: The SOP for balances and scales*. <https://www.mt.com/us/en/home/library/guides/laboratory-weighing/good-weighing-practice.html>

11. Related SOPs

SOP	Title	Relationship
L002	Laboratory Safety	Required prerequisite
L003	Hazardous Materials	Chemical spills on/near balance
L200	Balance Calibration	Calibration and external verification
L400	Soil Moisture	Weighing application
L406	Loss on Ignition	Weighing application

12. Training Record

Before using the laboratory balances independently, personnel must:

1. Read this SOP in full
2. Complete [SOP-L002 Laboratory Safety](#) training
3. Demonstrate proper leveling, zeroing, taring, and weighing technique under supervision
4. For the XPE205 precision balance, also demonstrate use of the draft shield and internal adjustment procedure
5. Be signed off by the PI or lab manager