

National Human Exposure Assessment Survey (NHEXAS)

Region 5 Study

Quality Systems and Implementation Plan for Human Exposure Assessment

Research Triangle Institute
Research Triangle Park, NC 27079
Cooperative Agreement CR 821902

Standard Operating Procedure

NHX/SOP-160-002

Title: Calibration of a Mettler M5 Analytical Balance

Source: Research Triangle Institute

U.S. Environmental Protection Agency
Office of Research and Development
Human Exposure & Atmospheric Sciences Division
Human Exposure Research Branch

Notice: The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), partially funded and collaborated in the research described here. This protocol is part of the Quality Systems Implementation Plan (QSIP) that was reviewed by the EPA and approved for use in this demonstration/scoping study. Mention of trade names or commercial products does not constitute endorsement or recommendation by EPA for use.

TITLE: STANDARD OPERATING PROCEDURE FOR CALIBRATION OF A
METTLER M5 ANALYTICAL BALANCE

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<u>STATUS:</u>	IN PROGRESS:	<input type="checkbox"/>
	DRAFT:	<input type="checkbox"/>
	FINAL VERSION:	<input checked="" type="checkbox"/>

REVISIONS:

No.	Date	No.	Date
0	†	6	
1		7	
2		8	
3		9	
4		10	
5		11	

† Effective date of this version is the date of the last approval signature;
revision 0 is the original version.

CALIBRATION OF A METTLER M5 ANALYTICAL BALANCE

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1.0 INSTRUMENTATION

The Mettler M5SA is a micro analytical balance with a range of 0-20 g and a readability of 2 µg.

2.0 GENERAL INSTRUCTION MANUAL

Copies of the instruction manual are kept by the ACS Support Office and in the QA Office. Instructions of operation for the balance are attached to the balance (a copy is included in this SOP); diagrams of the balance are shown in Figure 1.

3.0 CALIBRATION

The balance will be calibrated annually by the manufacturer or manufacturer's representative.

Calibration must be verified whenever balance is moved and when a standard weight cannot be weighed to within 1% deviation. The ACS Support Office will perform the calibration.

4.0 ROUTINE VERIFICATION OF CALIBRATION

This procedure must be carried out at each weighing session.

4.1 Zero the balance.

4.2 Verify calibration using two standard weights encompassing the weight range to be used in the weighing session.

4.3 Record in the instrument log notebook the date, balance, standard weights used, and recorded weights.

4.4 Calculate percent deviation.

$$\% \text{ Deviation} = \frac{W_R - W_S}{W_S} \times 100$$

where:

W_R = weight recorded on balance

W_S = standard weight

4.5 If deviation >1%, do not use balance. Contact the ACS Support Office.

4.6 The Quality Assurance Office maintains a set of reference standard weights in 119 Dreyfus.

5.0 DOCUMENTATION

5.1 A hard-bound book must be maintained for balance records.

5.2 All calibration information must be kept in the hard-bound book, including:

5.2.1 Date of calibration,

5.2.2 Name of person performing the calibration,

5.2.3 Results of the procedure.

5.3 All calibration verification information must be kept in the hard- bound book.

6.0 REFERENCES

Directions for Use, Mettler M5 Microbalance, Mettler Instrument Company,
Hightstown, New Jersey.

This SOP was originally issued January, 1984 (D. J. Smith, author). Revisions are marked with an asterisk (*) in the left margin.

Legend for Figure 1.

- A Weight setting knob**
- B Weight setting knob**
- C Weight setting knob**
- D Weight setting knob**

- 1 Balance arrest**
- 3 Zero adjustment knob**
- 4 Fine tare adjustment**
- 5 Adjusting weight**
- 6 Spirit level**
- 7 image focus knob**
- 8 Lamp image adjustment**
- 9 Lamp image adjustment**
- 10 Lamp**
- 12 Brake**
- 13 Flange for adjusting brake pin**
- 16 Micrometer**
- 18 Weight mechanisms**
- 19 Polished weights**
- 20 Damping pot**
- 21 Power plug cover**

INSTRUCTIONS FOR USING A MEASLER M5 BALANCE

Weighing

Weighing requires the following operations:

1 Checking the level

Check the spirit level (a) to ensure that balance is properly levelled. If necessary, relevel balance (see Levelling).

2 Checking zero point (knob (3))

- Unload pan and clean it if necessary
- Close side window
- Set all weights to 0
- Set micrometer scale to 0 with knob (4)
- Release balance fully
- When the projected scale is at rest, bring 0-line of scale with knob (3) exactly into centre of forked pointer
- Arrest balance (Position I)

3 Laying on objects to be weighed

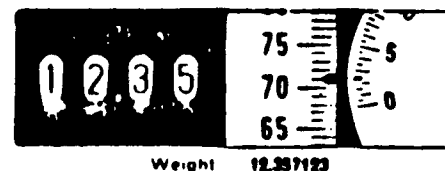
The object to be weighed may only be placed on the balance in the arrested state (Position I).

Whenever possible use a pair of tweezers to avoid humidity and heat being transmitted by the hands to the object to be weighed and inside the weighing chamber. After introducing object to be weighed, close side window immediately.

4 Weight setting (knobs A, B, C, D)

- Arrest balance and turn knob A (10 g) to the right
- Semi-release balance (Position II)
- If scale moves upward, arrest balance and turn back knob A
- If scale moves downward, turn knob B clockwise until scale moves upward. Turn back knob B by one place
- Repeat same operation with the remaining knobs for weight setting
- Arrest balance after having set the weights. (In this position, the pan brake becomes operative)
- Release balance fully and allow it to come to rest
- On M5, reading of last two decimal places is done with the aid of the micrometer as follows:
Turn micrometer knob anti-clockwise until next lower graduation lies exactly in center of forked pointer

Fig. 1

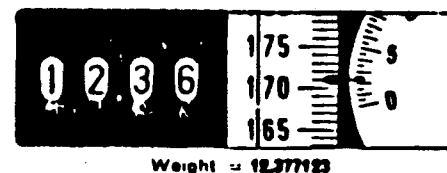


Caution: To avoid unnecessary heating, do not keep fingers on knob longer than necessary. Never follow up movement of scale with micrometer.

5 Facilitating differential weighing operations in the optical range

So as to make the most of the ± 0.002 mg accuracy of the optical range, the optical scale has a range of 20 mg and 200 graduations respectively. Thus, without operating the weight mechanism, differential weighing operations of at least 10 mg are possible in the optical range. The scale range between 10 and 20 mg has a black line. When this black line appears, one unit must be added to the last number of the counter.

Fig. 2



Adjustments

1 Levelling balance

Before doing any work on the balance, check whether it is properly levelled. If necessary, level the balance as follows:

- Observe spirit level (a) through front glass and adjust spirit level in the longitudinal axis by means of the two front foot screws
- Using the rear foot screw, bring spirit level exactly into circle

2 Zero point

With adjusting knob (3), the 0-line can be displaced by ± 3 graduations. If the deviation present is greater, i. e. no longer capable of being corrected with knob (3), then proceed as follows:

- Level balance accurately. (If balance was badly out of level, try once more to adjust zero point with knob (3))
- Remove cover
- With balance arrested, adjust fine taring weight (4). Turning fine taring weight clockwise raises the 0-line. Turning it counter-clockwise lowers the 0-line

