APPLICATION KNOWLEDGE

User Adjustment

Adaptation to different tip shapes

Overview

Precise pipetting requires not only high-quality pipettes, but also flexible options for adapting to changing conditions. The Transferpette® *pro* was developed precisely for this purpose: it combines high volume accuracy with simple adjustment functions so that reliable results can be achieved even under challenging conditions.

The following section explains temporary adjustment via user adjustment and the background to volume deviations caused by special pipette tips. In addition, you will find experimental examples for specific applications at the end.

Adjustment functions of the Transferpette® *pro*

The Transferpette® *pro* microliter pipette is an air-cushion pipette with two separate adjustment functions:

Factory adjustment (Easy Calibration):
The factory adjustment is used for permanent adjustment of the devices to aqueous media in accordance with ISO 8566 in the event of volume deviations.

Temporary User Adjustment:
The User Adjustment of the Transferpette® pro allows temporary adjustment to conditions that deviate from the Easy Calibration adjustment (factory setting) and is therefore particularly suitable for quick adjustments to changing conditions. A safe reset to the factory setting is possible at any time and can be done quickly.

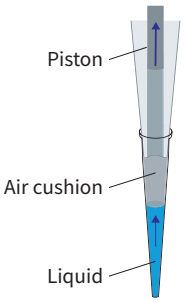
Applications:
+ Difficult liquid properties (e.g., density, viscosity, vapor pressure)
+ Temperature differences between the liquid and the environment
+ Special pipette tips

Permanent Easy Calibration technology

Temporary User Adjustment

Basics

In a microliter pipette (air cushion pipette), a piston moves a defined air cushion. This creates a vacuum that draws liquid into the pipette tip according to the volume of air moved. When the piston is moved in the other direction, liquid is expelled with the air cushion.
Pipettes are factory calibrated for standard tips (see user manual). If tips are used that differ in shape from the tips used, the volume may be altered.



Air cushion pipette

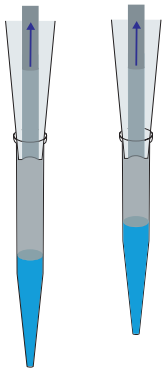
Challenge: Shape of the pipette tip

The negative pressure generated by the movement of the piston corresponds to approximately -1 mbar per cm of rise in the tip when using water. When using a tip with a geometry that differs from the standard tip, two important parameters may change:

+ **The size of the air cushion (amount of air between the liquid and the piston):**
  The larger the air cushion, the more it can expand at the same negative pressure—meaning that less liquid is drawn up.

+ **The rise height of the liquid in the pipette tip:**
  As the rise height increases, the vacuum increases and the air cushion expands. If, for example, the liquid level is higher for a given volume due to a slim tip, less liquid is drawn up due to the larger air cushion volume.

These parameters increase with increasing liquid volume and the associated rise height.



Air cushion depending on the tip shape

For these reasons, we recommend using the test tips provided by the pipette manufacturer for factory calibration to achieve the best results. If other tips are used on a permanent basis, it may be advisable to have the pipette adjusted to these tips at the factory.

In addition, there are other tips that are optimized for various applications, such as filter tips to prevent contamination or extended-length tips for working in narrow vessels. User adjustment can be used here to partially or completely compensate for the effects of the tip types.

Temporary adjustment: User Adjustment

How to perform User Adjustment:

1. Determine volume deviation using gravimetric testing and the following simplified formulas.

$$\text{Actual volume} = \frac{\text{Mean of liquid weights}}{\text{Density of liquid} - \text{Density of air (0.0012 g/ml)}}$$

$$\text{Volume offset} = \text{Target volume} - \text{Actual volume}$$

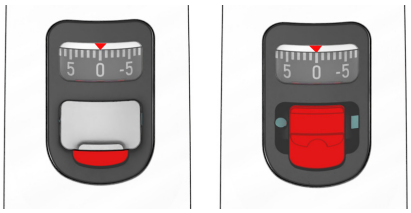
2. Transfer or calculate the User Adjustment value from the assignment table (see below).

3. Set the User Adjustment value on the back of the device.

Example:
Pipetting 180 µl with a 20–200 µl pipette

+ Actual volume determined: 178.4 µl
+ Volume offset: 1.6 µl (=180 µl - 178.4 µl)
+ With our 200 µl device, each mark corresponds to a step value of 0.2 µl (see assignment table).
  A volume offset of 1.6 µl is added by setting +8 (= 1.6 µl / 0.2 µl).

$$\text{User Adjustment value} = \frac{\text{Volume offset}}{\text{Step value}}$$

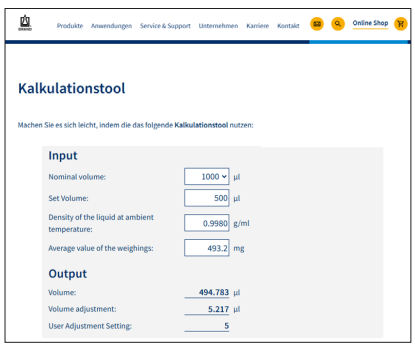


User Adjustment with closed (left) and open (right) cover

Note: User Adjustment per volume
If the user adjustment compensates for a volume, this only applies to the selected volume. If you change the set volume, the required user adjustment value will usually also change.

Calculation tool

You can find a helpful calculation tool at
http://www.brand.de/uad



Setting the User Adjustment

1. Pry off and remove the cover (1) and seal (2) (e.g., using a paperclip). Dispose of the seal.
2. Slide the slider (3) down into the recess and hold it there. Use the volume-setting wheel (4) to set the desired User Adjustment value (see below) on the scale. Release the volume-setting wheel and slowly return the slider (3).

   If the slider is stuck, gently push it back toward the recess (3) and slowly return it again.

   → The value is set when the user adjustment value aligns with the marking (5).
3. Reinsert the cover (1).
4. Verify the adjustment gravimetrically.

User Adjustment einstellen

Assignment table for User Adjustment

Note: The table shows the mechanical relationship between the steps of the User Adjustment. The volume changes indicated are approximate values and apply to the entire volume range of the instrument.

	The highlighted column [1] indicates the step value for the respective instrument														
	–25	**–20**	**–15**	**–10**	**–5**	**–1**	**0**	**1**	**5**	**10**	**15**	**20**	**25**	**30**	**35**
Nominal volume µl	The step value corresponds to a volume compensation in µl:														
1	–0.025	–0.02	–0.015	–0.01	–0.005	–0.001	0	0.001	0.05	0.01	0.015	0.02	0.025	0.03	0.035
2.5	–0.05	–0.04	–0.03	–0.02	–0.01	–0.002	0	0.002	0.01	0.02	0.03	0.04	0.05	0.06	0.07
10	–0.25	–0.2	–0.15	–0.1	–0.05	–0.01	0	0.01	0.05	0.1	0.15	0.2	0.25	0.3	0.35
20	–0.5	–0.4	–0.3	–0.2	–0.1	–0.02	0	0.02	0.1	0.2	0.3	0.4	0.5	0.6	0.7
50	–1.25	–1	–0.75	–0.5	–0.25	–0.05	0	0.05	0.25	0.5	0.75	1	1.25	1.5	1.75
100	–2.5	–2	–1.5	–1	–0.5	–0.1	0	0.1	0.5	1	1.5	2	2.5	3	3.5
200	–5	–4	–3	–2	–1	–0.2	0	0.2	1	2	3	4	5	6	7
300	–6.225	–4.98	–3.735	–2.49	–1.245	–0.249	0	0.249	1.245	2.49	3.735	4.98	6.225	7.47	8.715
1000	–25	–20	–15	–10	–5	–1	0	1	5	10	15	20	25	30	35
1250	–25	–20	–15	–10	–5	–1	0	1	5	10	15	20	25	30	35
2500	–50	–40	–30	–20	–10	–2	0	2	10	20	30	40	50	60	70
5000	–125	–100	–75	–50	–25	–5	0	5	25	50	75	100	125	150	175
10000	–250	–200	–150	–100	–50	–10	0	10	50	100	150	200	250	300	350
	Volume offset for excess volume							Volume offset for missing volume							

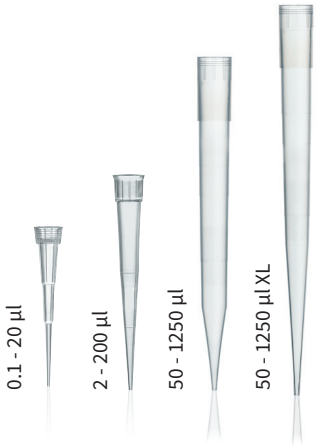
Restore factory adjustment, reset User Adjustment

To reset the User Adjustment, set it to 0 on the scale. This restores the factory adjustment state. We recommend performing a volume checkafterward.

Applications Tip shapes

All sample values were determined under the following conditions.

+ Device, media, and room temperature: approx. 21 °C + Liquid: fully desalinated water
+ Media temperatures: approx. 21 °C
+ Pipetting technique: standard (forward pipetting)
+ Tips: A new tip was inserted before each new measurement. The tips were not conditioned before pipetting, i.e., each tip was filled once and the first dispensing was weighed.



The following examples show differences between small volumes, medium volumes, and large volumes, as well as between different shapes such as long or short tips.
It also shows that there are significant differences between individual volume ranges (100%, 50%, 10% of the nominal volume), but that these differences are by no means linear from one volume range to another.

Note:
The following examples are experimentally determined values. Since pipetting technique and environmental conditions greatly influence the determined values, we recommend determining the required correction yourself using a precision balance for the required volumes, see calculation under 'Temporary adjustment: User adjustment, p. 2'.

Difference compensation between short and long peaks

Difference compensation between short and long peaks

Examples

Transferpette® *pro* Single channel: 10 - 1000 µl
Standard tip: 50 – 1000 µl (732212)
Tip used: 1250 µl (TipBox 732214)

Target Volume [µl]	Difference [µl]	User Adjustment
1000	–2.5	3
500	–1.0	1
100	–0.2	0

Transferpette® *pro* Single channel: 10 - 1000 µl Standard tip: 50 – 1000 µl (732212)
Tip used: 1250 µl XL (TipBox 732217)

Target Volume [µl]	Difference [µl]	User Adjustment
1000	–7.3	7
500	–5.2	5
100	–1.8	2

Volume between standard tips (0.5–20 µl) and NanoCap tips (0.1–20 µl)

We recommend 0.5–20 µl tips as standard tips for the following pipettes. If you regularly pipette small volumes, optimized NanoCap tips may be useful.

Examples

Transferpette® *pro* Single channel: 0.1 – 2.5 µl
Standard tip: 0.5 – 20 µl (TipBox 732204)
Tip used: 0.1 – 20 µl (TipBox 732202)

Target Volume [µl]	Difference [µl]	User Adjustment
2.5	–0.09	35*
1.25	–0.04	20
0.25	0.00	0

* 35 corresponds to the maximum volume correction (0.07 µl) for this pipette and only partially compensates for the difference.

Transferpette® *pro* Single channel: 0.5 – 10 µl
Standard tip: 0.5 – 20 µl (TipBox 732204)
Tip used: 0.1 – 20 µl (TipBox 732202)

Target Volume [µl]	Difference [µl]	User Adjustment
10	–0.01	1
5	–0.01	1
1	–0.05	5

Transferpette® *pro* multichannel: 0.5 – 10 µl
Standard tip: 0.5 – 20 µl (TipBox 732204)
Tip used: 0.1 – 20 µl (TipBox 732202)

Target Volume [µl]	Difference [µl]	User Adjustment
10	0.00	0
5	–0.01	1
1	–0.05	5

Transferpette® *pro* multichannel: 2 – 20 µl (gray)
Standard tip: 0.5 – 20 µl (TipBox 732204)
Tip used: 0.1 – 20 µl (TipBox 732202)

Target Volume [µl]	Difference [µl]	User Adjustment
20	–0.01	1
10	0.00	0
2	–0.36	18

Further applications

You can find further technical notes on various media temperatures, peak shapes and sizes, and special media at www.brand.de.

Template documentation
User adjustment values

You can use these form fields to document frequent user adjustments. Enter values in the fields and simply save them. Or create your own Excel spreadsheet.

Application	Conditions*	Nominal volume	Target volume	User Adjustment
Example: XL tips		*1000*	*100*	*+8*

* The conditions describe your pipetting technique and external influences such as temperature, liquid, and other conceivable influencing factors.

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