APPLICATION KNOWLEDGE

User Adjustment

Adaptation to temperature differences

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.

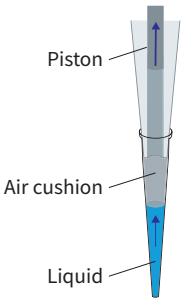
Applications:
+ Difficult liquid properties (e.g., density, viscosity, vapor pressure)
+ Temperature differences between the liquid and the environment
+ Special pipette tips

Permanent Easy Calibration technology

Temporary User Adjustment

Basics

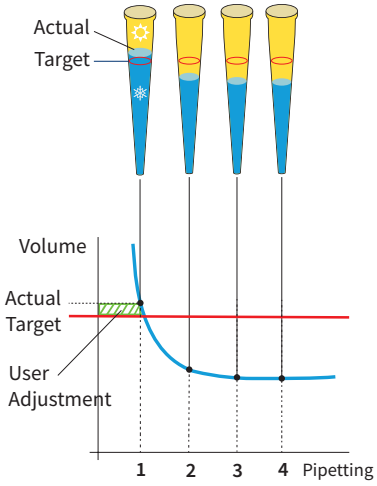
In a microliter pipette (air cushion pipette), a piston moves a defined air cushion. This creates a vacuum that draws liquid into the pipette tip according to the volume of air moved. When the piston is moved in the other direction, liquid is expelled with the air cushion.
Pipettes are calibrated at the factory at a temperature equilibrium between the water, pipette, and environment (in accordance with ISO 8655-6). Temperature differences between the liquid, pipette, and environment alter the air cushion in the pipette, thereby affecting the accuracy of the volume measurement.



Air cushion pipette

Challenge: Fluid temperature

When aspirating cold liquids, the air cushion contracts during the first pipetting (1), causing slightly too much volume to be aspirated. With each subsequent pipetting (2) ... (4), the air cushion repeatedly moves from the cooled pipette tip to the warmer pipette body and expands during aspiration. This results in a volume decrease significantly below the target volume.
With warm liquids, this effect occurs in reverse: the air cushion initially expands, causing slightly too little volume to be drawn up in the first pipetting step. With further pipetting steps, the volume is then significantly increased.



Influence of fluid temperature on actual volume

For these reasons, we always recommend allowing the pipette, liquid, and environment to acclimatize to the same temperature (min. 2 hours).

Special pipetting conditions

In some cases, the application does not allow for temperature compensation, e.g., when working with enzymes without access to a cold room. The influence of temperature on the air cushion is lowest during the first pipetting. We therefore recommend not preconditioning the tip and changing it after each pipetting.

If temperature compensation is not possible, the resulting volume deviation can be determined using a precision scale and corrected via User Adjustment (see 'Temporary adjustment: User Adjustment, p. 3).

Temporary adjustment: User Adjustment

How to perform User Adjustment:

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

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

Volume offset = Target volume – Actual volume

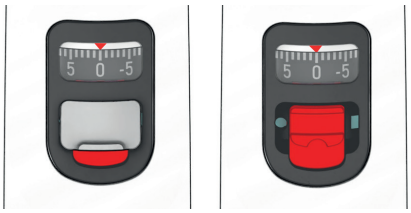
2. Transfer or calculate the User Adjustment value from the assignment table (see below).

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).

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

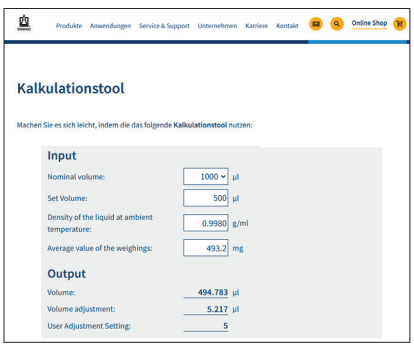


User Adjustment with closed (left) and open (right) cover

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 Temperatures

All sample values were determined under the following conditions.

+ Device, media, and room temperature: approx. 21 °C
+ Liquid: fully desalinated water
+ Media temperatures: 1 °C | 15 °C | 37 °C
+ Pipetting technique: Standard (forward pipetting)
+ Tips: A new tip was inserted before each new measurement. The tips were filled once and the first dispensing was weighed.

In the following example, Transferpette® *pro* 10 ... 100 µl, a deviation of 0.1 µl was determined at a set volume of 10 µl, using a 200 µl tip and at a medium temperature of 15 °C (fully deionized water). This corresponds to a 1% deviation at this medium temperature in relation to the set volume. The setting of -1 in User Adjustment compensates for this deviation, i.e., the pipette then achieves the same accuracy at a medium temperature of 15 °C as in the factory calibration at a medium temperature of 21 °C (calibration according to ISO 8655-6).

Target Volume [µl]	Difference calibration [µl] 1 °C | 15 °C | 37 °C			User Adjustment 1 °C | 15 °C | 37 °C		
10	0.4	0.1	-0.4	-4	-1	4
50	0.5	0.1	-0.4	-5	-1	4
100	0.6	0.2	-0.4	-6	-2	4

Further examples

Transferpette® *pro* 1 … 10 ml
Tips used 1 - 10 ml (TipBox 702608)
Medium: deionized water

Target Volume [µl]	Difference calibration [µl] 1 °C | 15 °C | 37 °C			User Adjustment 1 °C | 15 °C | 37 °C		
1000	10	10	–8	–2	–1	1
5000	24	9	–18	–2	–1	2
10000	17	16	–10	–2	–2	1

Transferpette® *pro* 100 …1000 µl
Tips used 50 – 1000 µl (TipBox 732212)
Medium: deionized water

Target Volume [µl]	Difference calibration [µl] 1 °C | 15 °C | 37 °C			User Adjustment 1 °C | 15 °C | 37 °C		
100	4	0.4	–3	–4	0	3
500	4	0.7	–3	–4	–1	3
1000	3	1.5	0.4	–3	–1	0

Transferpette® *pro* 0,5 …10 µl
Tips used 0,5 - 20 µl (TipBox 732204)
Medium: deionized water

Target Volume [µl]	Difference calibration [µl] 1 °C | 15 °C | 37 °C			User Adjustment 1 °C | 15 °C | 37 °C		
1	0.13	0.03	–0.07	–13	–3	7
5	0.10	0.01	–0.09	–10	–1	9
10	0.13	0.00	–0.11	–13	0	11

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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