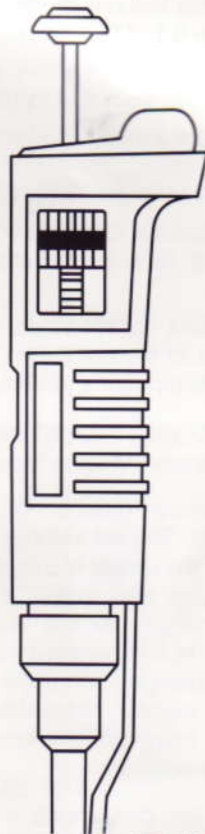
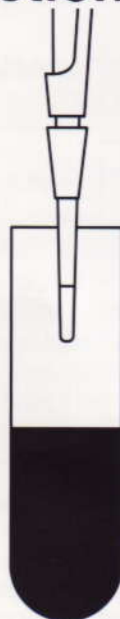


High level



VWR ™

**Pipettor
Instruction Manual**



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VWR™ Variable Volume Digital Pipettors cover the range from 0.1 μl to 5000 μl .

VWR™ Fixed Volume Pipettors are available in standard volumes from 5 μl to 1000 μl .

VWR™ Pipettors are equipped with a removable, adjustable tip ejector. For convenience, models are also supplied without a tip ejector.

VWR™ Pipettors are made of corrosion resistant materials and require minimal preventative maintenance.

VWR™ Pipettors accept white, yellow or blue tips. The color of the correct tip is indicated by the color of the pipettor's pushbutton.

VOLUME ADJUSTMENT (Variable Volume Models)

Select the proper pipettor for the operating range required. The set volume is displayed in the window in the center of the pipettor body. To read the display, refer to the "examples" table below. To change the set volume, turn the knurled knob in the handle in the appropriate direction. To obtain the best accuracy, it is recommended to slightly overshoot the volume required and then turn the knob back to the actual desired volume.

EXAMPLES

Catalog Number	Display	Volume	Increment
40000-264	1	1.25 μl	0.002 μl
	2		
	5		
40000-248 40000-200 40000-250 40000-202	0	6.5 μl	0.02 μl
	6		
	5		
	5		
40000-252 40000-206 40000-254 40000-204	0	85.0 μl	0.2 μl
	8		
	5		
	5		
40000-256 40000-208	0	530 μl	2.0 μl
	5		
	3		
40000-210	3	3550 μl	10 μl
	5		
	5		

SUGGESTED METHOD OF USE

Refer to the diagram.

- Select the correct tip and place it firmly on the nose of the pipettor using a slight screwing action. NEVER USE THE PIPETTOR WITHOUT A TIP ATTACHED as serious damage will result.
- Prior to immersing the tip in the liquid to be measured and dispensed, depress the pushbutton to the first stop.
- Hold the pipettor vertically and immerse the tip in the liquid to a depth of 3 to 5 mm.
- Release the button in a slow, controlled manner to aspirate the sample. If the button is not released in a slow, controlled manner, poor accuracy and precision will result.

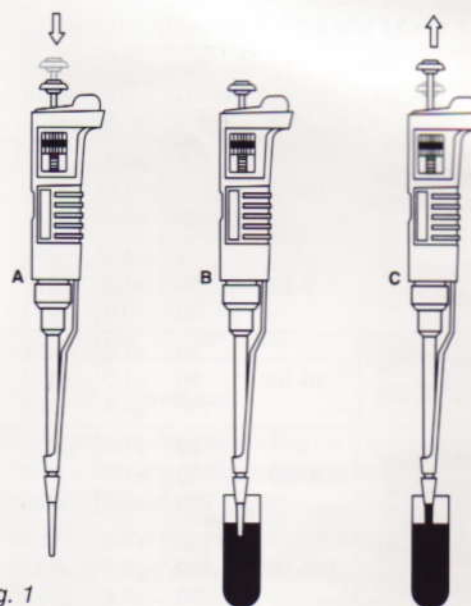


Fig. 1

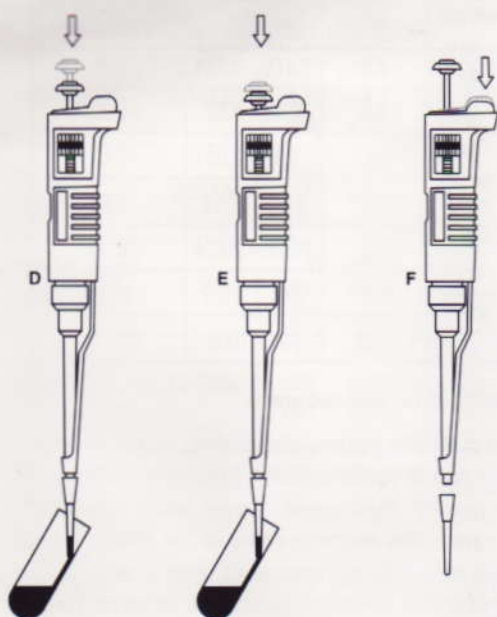
- Remove the tip slowly from the liquid while holding the pipettor vertically. DO NOT WIPE THE TIP with a tissue.
- Place the tip of the pipettor in the bottom of the receiving container.
- Dispense the contents by pressing the button to the second stop. Touch off on the side of the container while slowly removing the pipettor.
- Press the ejector button (if so equipped) and eject the tip into the proper container for safe disposal.

OPERATING HINTS

- Ensure that the tip is correctly fitted on the pipettor shaft. A poor fitting tip will leak and affect results.
- Always aspirate and dispense samples in a slow, controlled manner. This will increase accuracy and avoid the entrance of liquid into the nose of the instrument.
- Prewet tips when working with viscous samples.
- For best results, reagents should be allowed to reach room temperature before pipetting. Deep frozen samples should be allowed to warm to room temperature when possible and mixed well before use.
- Always keep the pipettor in a vertical position during use. A pipettor with liquid in the tip should not be laid on the bench. Dispose of tips properly and place the pipettor in a stand after use.

MAINTENANCE

The pipettor should be cleaned after use with strong acid or alkaline solutions. Remove the ejector by pressing the ejector button and easing the ejector mechanism off of the shaft. Unscrew the nut at the top of the shaft and remove the



shaft, piston, gasket and O-ring. All parts can then be washed in pure water and dried. Reverse the process to reassemble the pipette.

ADJUSTING THE TIP EJECTOR

Push the tip ejector button downwards and ease the lower end of the tip ejector off the shaft. Rotate the ejector clockwise or counter-clockwise to raise or lower it on the shaft. Press the tip ejector button and ease the ejector back on the shaft. To remove the ejector, keep turning until the ejector comes off of the screw.

TROUBLESHOOTING

Symptom	Cause	Solution
Liquid remains in tip	Contaminated tip	Replace tip
	Dispensing too rapid	Dispense slowly
	"Blow out" not used	Depress button to 2 nd stop
Leaking tips	Poor fitting tip	Tighten tip
	Damaged tip	Replace tip
	Loose shaft	Tighten shaft
Incomplete aspiration	Loose or damaged tip	Tighten or replace tip
	Blocked airway	Clean pipettor shaft
	Liquid in pipettor	Disassemble and clean

To clean a contaminated shaft, rinse in a 10% bleach solution followed by a thorough rinse in pure water. Dry all parts, reassemble and check for leaks.

PERIODIC ACCURACY AND PRECISION CHECK

As with any instrument, it is recommended to verify the performance of the pipette at regular intervals (ie every three months, or more often if the pipettor is used heavily). Accuracy and precision can be checked by carrying out 10 consecutive weighings of distilled water and looking at the mean, standard deviation and coefficient of variation to monitor the performance of the pipettor.

VERIFYING ACCURACY AND PRECISION

The simplest and recommended method to verify the performance of the pipette is the gravimetric method. The procedure employs the weight of water at a known temperature to determine the dispensed volume.

The requirements are:

- An analytical balance (electronic auto-tare is preferable) of suitable sensitivity. The chart below can be used as a guide for balance sensitivity.

Table A

Volume checked [μ l]	Balance sensitivity [mg]
0.1 - 10	≤ 0.001
10 - 100	≤ 0.01
≥ 100	≤ 0.1

The above table is that used by pipettor manufacturers. As a user, it would be reasonable to accept one decimal place less in sensitivity. Care must be taken to avoid errors due to measuring across sensitivity or weight classes.

- Thermometer
- Weighing vessel, 5 ml, with lid
- Distilled water

TECHNIQUE

- Place 1 ml of water inside the weighing vessel, keeping hands and the outside of the container dry.
- Place the container on the balance and tare the balance, ie zero.
- Measure and record the temperature of the distilled water to be used for the test. Ideally the temperature should be $20^{\circ} \pm 1^{\circ}\text{C}$.
- Aspirate a set volume of water from the test reservoir.
- Check that the balance is at zero.
- Remove the weighing vessel from the balance. Remove the lid and deliver the test water into the container. Replace the cap and weigh. Record the weight.
- Repeat steps 4 through 6 for a total of 10 samples. Try to maintain a standard timed procedure. An experienced operator will make one weighing every 15 to 20 seconds.
- Calculate aspirated volume in μ l multiplying the aspiration amount [mg] by the distilled water density coefficient [μ l/mg], according to the following Table B.

Table B

Temperature [$^{\circ}\text{C}$]	Pressure [hPa]		
	960	1013	1067
20	1.0028	1.0029	1.0029
21	1.0031	1.0032	1.0032
22	1.0032	1.0033	1.0033
23	1.0035	1.0035	1.0036
24	1.0037	1.0038	1.0038
25	1.0039	1.0040	1.0041

- Using the formulae in the next section or a scientific calculator, calculate the mean, standard deviation and coefficient of variation of your results.

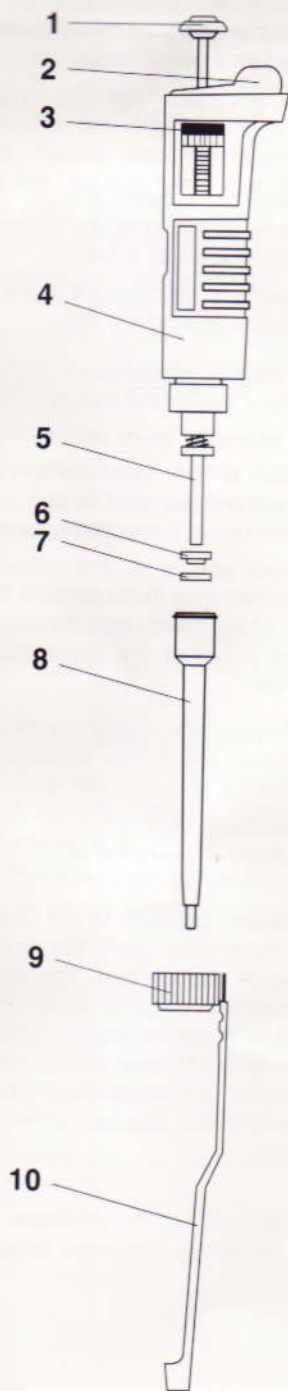


Fig. 2

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DEFINITIONS AND FORMULAE

Accuracy, also referred to as inaccuracy, is the mean of the volume delivered minus the nominal value expressed as a percentage.

$$A = \frac{\bar{x} - v}{v} \times 100\%$$

Where:

v – nominal value of the pipettor in μl
 \bar{x} – mean volume delivered by the pipettor in μl
A – accuracy expressed as a percent

Standard deviation is the measure of the scatter of the observations around the mean.

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

Where:

x – the individual sample measurement in μl
 \bar{x} – the mean volume delivered in μl
n – the total number of measurements taken

Coefficient of variation or imprecision is the standard deviation of the distribution expressed as a percent of the mean of the distribution independent of units.

$$CV = \frac{SD}{\bar{x}} \times 100\%$$

Where:

SD – standard deviation
 \bar{x} – mean volume delivered in μl

If the accuracy and precision of the pipette vary from the Technical Data Chart, the pipette may need servicing or recalibration. The **VWR™** pipettor is supplied with a key for in-lab calibration. Spare parts, such as seals, are also available for in-lab service. To recalibrate the pipette, follow the instructions in this manual or call you **VWR™** representative to obtain service.

RECALIBRATION

The pipette is calibrated by gravimetric method using distilled water, at temperature $20 \pm 0.5^\circ\text{C}$, according to DIN 12650.

If during pipette operation you find that the accuracy error (the difference between the real aspirated volume and the present volume) exceeds the permissible value given in the Technical Data chart, the pipette recalibration procedure should be carried out.

Before starting the recalibration it is necessary to check whether the following requirements have been fulfilled during error determination:

- the ambient temperature, and the temperature of the pipette, tips and water was identical
- the density of the liquid used was close to that of distilled water
- the balance with appropriate sensitivity has been used acc. Table A
- mg/ μl conversion factor has been taken into account
- the requirements given in chapters: Suggested method of use and Operating hints.

If the above conditions are satisfied and the accuracy error for selected volume given in the Technical Data chart exceeds the permissible value, the pipette recalibration procedure should be carried out.

The recalibration can be performed within one full turn of the key to the right or to the left only.

Recalibration conditions:

- Ambient temperature and the temperature of the pipette, tips and liquid should be within the range $20-25^\circ\text{C}$ and stabilized during weighing within $\pm 0.5^\circ\text{C}$
- Measurements should be conducted using distilled water
- Balance sensitivity should be suitable for the volume to be controlled (Table A)

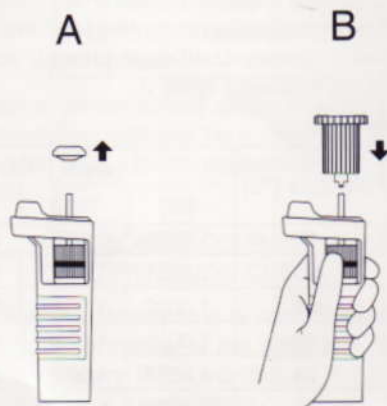


Table C

Range of the pipette volumes [μl]	Preset volume [μl]	Permissible volumes [μl]	Volume change ΔV for full turn of the calibration key [μl] (24 increments)
0.1 - 2	0.2	0.176 - 0.224	0.06
0.5 - 10	0.5	0.48 - 0.52	0.33
2 - 20	2	1.92 - 2.08	0.63
10 - 100	10	9.84 - 10.16	2.50
20 - 200	20	19.76 - 20.24	6.30
100 - 1000	100	99.1 - 100.9	25.00
1000 - 5000	1000	994 - 1006	125.00

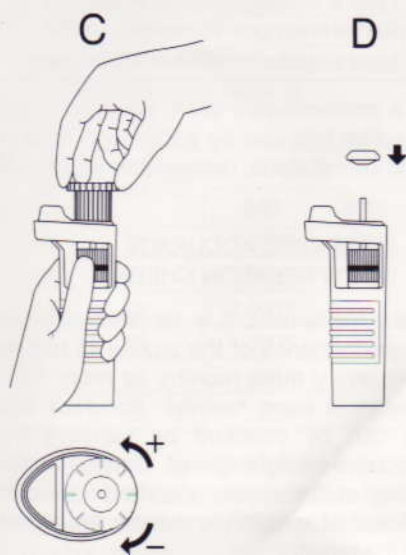
Recalibration procedure:

- Set the dose volume depending on the pipette volume according to the following table:
- Perform 5 aspirations, weigh each one and calculate the average value of the aspirations
- Calculate average aspirated volume in μl multiplying the average aspiration amount [mg] by the distilled water density coefficient [$\mu\text{l}/\text{mg}$], which depends on temperature and pressure according to the Table B

If the average aspirated volume exceeds the permissible value, the following should be done:

- Remove the pipetting pushbutton, (Fig. A)
- Holding the volume setting knob to protect it against rotation, insert the calibration key into the cuts of the calibration screw, (Fig. B)
- Turn the key clockwise to reduce the aspirated volume, or counter-clockwise to increase the volume, (Fig. C). One full turn of the calibration key changes the pipette aspiration volume by the amount given in the table
- Take out the key and fix the pipetting pushbutton, (Fig. D)

Determine the average aspirated volume. The average volume should be within the permissible range given in the table. If the volume exceeds the values stated, the recalibration procedure should be repeated.



TECHNICAL DATA

Catalog number	Volume range (μl)	Accuracy (μl) (%)	Precision (%)
VWR™ Digital Variable			
40000-264	0.1-2.0	0.2 ± 12.0	≤ 6.0
		1.0 ± 2.7	≤ 1.3
		2.0 ± 1.5	≤ 0.7
40000-248* 40000-200	0.5-10	0.5 ± 4.0	≤ 4.0
		5 ± 1.0	≤ 0.8
		10 ± 0.5	≤ 0.4
40000-250* 40000-202	2-20	2 ± 4.0	≤ 3.0
		10 ± 1.0	≤ 0.7
		20 ± 0.8	≤ 0.4
40000-252* 40000-206	10-100	10 ± 1.6	≤ 0.8
		50 ± 1.0	≤ 0.4
		100 ± 0.8	≤ 0.3
4000-254* 4000-204	20-200	20 ± 1.2	≤ 0.6
		100 ± 1.0	≤ 0.3
		200 ± 0.6	≤ 0.3
40000-256* 40000-208	100-1000	100 ± 0.9	≤ 0.45
		500 ± 0.7	≤ 0.25
		1000 ± 0.6	≤ 0.25
40000-210*	1000-5000	1000 ± 0.6	≤ 0.3
		2500 ± 0.6	≤ 0.3
		5000 ± 0.5	≤ 0.2
VWR™ Fixed			
40000-228	5	± 1.6	≤ 1.0
40000-230	10	± 1.0	≤ 0.6
40000-232	20	± 0.8	≤ 0.4
40000-234	25	± 0.8	≤ 0.4
40000-236	50	± 0.8	≤ 0.4
40000-238	100	± 0.8	≤ 0.3
40000-240	200	± 0.6	≤ 0.3
40000-242	250	± 0.6	≤ 0.3
40000-244	500	± 0.5	≤ 0.3
40000-246	1000	± 0.4	≤ 0.3

* no ejector

Condition of measurements distilled water at temperature $20 \pm 1^\circ\text{C}$, number of measurements - minimum 10.

ACCESSORIES

40000-270	Carousel Stand
40000-272	Linear Stand

SPARE PARTS

Fig. 2. Show the pipette design and its elements the replacement parts are marked with bold typefaces:

1. **Operating pushbutton**
2. **Ejector pushbutton**
3. **Calibration knob**
4. Body
5. **Piston**
6. **Teflon gasket**
7. **O-ring**
8. **Shaft**
9. **Nut**
10. **Ejector**