

# Pipet-Plus<sup>®</sup>

Latch-Mode™ Pipette

continuously-  
adjustable  
digital  
microliter  
pipette

9 pipettes for  
volume ranges  
from  
0.1  $\mu$ L to 10 mL

Pipet-Plus 200  $\mu$ L shown



**RAININ**

## TABLE OF CONTENTS

Introduction .....	1
Setting Aspiration Rate Controller.....	2
Setting Volume.....	2
Filter .....	3
Tip Selection and Mounting .....	3
Operation .....	4
Tip Ejector Arm Removal .....	6
Pipetting Guidelines.....	6
Pre-Rinsing Recommended .....	6
Mixing .....	7
Pipetting Liquids of Varying Density.....	7
Temperature Considerations .....	7
Tip Immersion Depth .....	7
Pipet-Plus Storage.....	8
Troubleshooting and Repairs.....	8
Service, Calibration, and Repair .....	9
Replacement Parts .....	12
Specifications .....	13
Autoclaving .....	13
Contacting RAININ.....	Back Cover

## FIGURES

Figure 1	Pipet-Plus Pipette.....	1
Figure 2	Filter Orientation.....	3
Figure 3	Operating Pipet-Plus .....	5
Figure 4	Removing the Tip Ejector Arm.....	6

## LINE DRAWINGS

Pipet-Plus	2 $\mu$ L .....	10
Pipet-Plus	10 $\mu$ L .....	10
Pipet-Plus	20 $\mu$ L .....	10
Pipet-Plus	100 $\mu$ L .....	10
Pipet-Plus	200 $\mu$ L .....	10
Pipet-Plus	1000 $\mu$ L .....	11
Pipet-Plus	2000 $\mu$ L .....	11
Pipet-Plus	5000 $\mu$ L .....	11
Pipet-Plus	10 mL .....	11

# Introduction

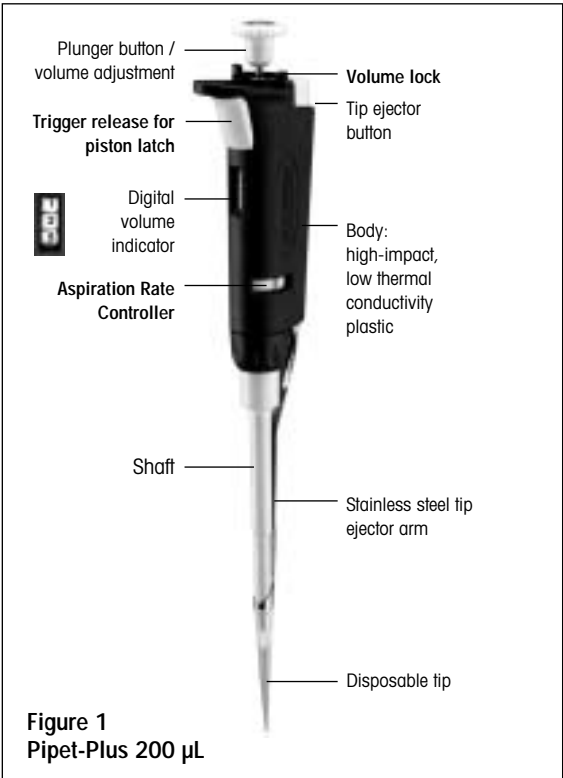
RAININ Pipet-Plus pipettes redefine manual pipetting. Pipet-Plus differs from conventional manual pipettes by using a latch trigger mechanism and aspiration rate controller. These features improve precision from sample to sample and from technician to technician.

Designed as a system with thin-wall RAININ tips, Pipet-Plus helps reduce the risk of cumulative trauma disorders by reducing the number of thumb strokes by 50% and by using light spring and tip ejector forces.

**Piston Latch/Trigger Release:** The patented **piston latch** secures the piston at the zero point. A light touch on the **trigger release** starts the pick-up stroke.

**Aspiration Rate Controller:** Pick-up stroke speed is governed by a patented **aspiration rate controller** that can easily be set for fast or slow operation, depending on sample viscosity. Even at the fastest setting, piston speed is constrained to prevent sample splash.

**Volume Lock:** The variable-resistance **volume lock** prevents inadvertent changes to the volume setting. The volume setting can be locked or unlocked by turning the control wings.



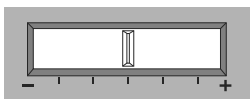
**Figure 1**  
**Pipet-Plus 200 µL**

## Setting Aspiration Rate Controller

To change the setting, slide the control left or right. The fastest speed setting (for aqueous samples) is with the control to the right.

### Close-up of Aspiration Rate Controller

Slower Speed:  
viscous or shear-sensitive samples



Faster Speed:  
aqueous samples

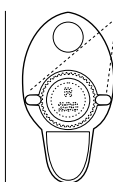
## Setting Volume

1. Turn the volume lock counter-clockwise to the position shown at left below. In this position the volume setting mechanism is unlocked and turns freely.

### Top view of Pipet-Plus



UNLOCKED



Volume is locked when wings are oriented straight across.

LOCKED

2. With the mechanism unlocked, turn Pipet-Plus so you are looking at the digital volume indicator, then rotate the plunger button to change volume.

Rotate the plunger button counter-clockwise to increase, and clockwise to decrease the volume.

The digital volume indicator is read the top down.

2 $\mu$ L	10 $\mu$ L	20 $\mu$ L	100 $\mu$ L	200 $\mu$ L	1000 $\mu$ L	2000 $\mu$ L	5000 $\mu$ L	10mL
1	0	1	0	1	0	1	4	0
2	7	2	7	2	7	2	2	7
5	5	5	5	5	5	5	5	5
1.25 $\mu$ L	7.5 $\mu$ L	12.5 $\mu$ L	75 $\mu$ L	125 $\mu$ L	0.75mL	1.25mL	4.25mL	7.50mL
Red digits				Black digits				

2–20  $\mu$ L: Black –  $\mu$ L. Red – tenths, hundredths of  $\mu$ L.

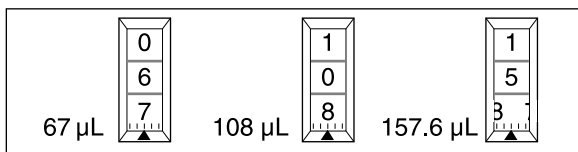
100–200  $\mu$ L: All digits black – whole  $\mu$ L.

1000–5000  $\mu$ L: Red – mL. Black – tenths, hundredths of mL.

10 mL: Red – mL. Black – tenths of mL.

3. To eliminate errors due to mechanical backlash: when setting the desired volume, first turn the knob  $\frac{1}{3}$  turn above the desired volume. Then turn the knob slowly clockwise until the desired volume is displayed. **Always dial down to the desired volume.**
4. Turn the volume lock clockwise to prevent accidental changes to the volume setting.

Example volumes for the 200  $\mu\text{L}$  size are shown below.

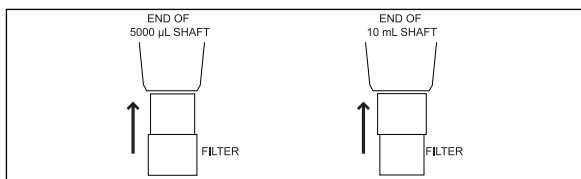


Volumes can be changed whether the piston is latched or unlatched. Volume ranges/ increments are shown below:

Pipet-Plus Volume	Range ( $\mu\text{L}$ )		Smallest Increment $\mu\text{L}$
	Adjustable	Recommended	
2 $\mu\text{L}$	0 to 2	0.1 to 2	0.002
10 $\mu\text{L}$	0 to 10	0.5 to 10	0.02
20 $\mu\text{L}$	0 to 20	2 to 20	0.02
100 $\mu\text{L}$	0 to 100	10 to 100	0.2
200 $\mu\text{L}$	0 to 200	20 to 200	0.2
1000 $\mu\text{L}$	0 to 1,000	100 to 1,000	2.0
2000 $\mu\text{L}$	0 to 2,000	200 to 2,000	2.0
5000 $\mu\text{L}$	0 to 5,000	500 to 5,000	5.0
10 mL	0 to 10 mL	1 mL to 10 mL	20.0

## Filter

Pipet-Plus 5000  $\mu\text{L}$  and 10 mL pipettes use a filter in the end of the shaft to help prevent liquid entering the shaft and contaminating the piston, should the plunger snap up during aspiration. Using such a filter is particularly important when pipetting large volumes. Replace the filter if it gets wet.



**Figure 2 Filter Orientation**

For 5000  $\mu\text{L}$  pipettes insert the small diameter into the shaft, for 10 mL pipettes insert the large diameter into the shaft. Filter part numbers are 6190-164 (pack of 100) and 6190-165 (pack of 1000).

## Tip Selection and Mounting

Always use RAININ tips. Pipet-Plus pipettes are calibrated with RAININ tips, and performance to published specifications can only be guaranteed when RAININ tips are used.

To mount a tip, press the Pipet-Plus shaft into the end of the tip with light force. RAININ tips will always seal properly on the shaft with minimal force — do not use more force than is required.

## Operation

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Before pipetting valuable samples, it is a good idea to practice pressing the plunger then releasing the latch using the trigger. This will allow you to get familiar with aspirating without using your thumb.

Try this several times without any liquid in the tip. Then practice aspirating and dispensing water.

1. Set the aspiration rate control and the desired volume as described on page 2.
2. Attach a new RAININ tip by lightly inserting the shaft into the tip. This ensures a positive airtight seal.
3. Press the plunger button fully — to the blowout position — and release your thumb. (A & B in Figure 3). The piston returns to the zero point and latches automatically, ready to pick up the volume displayed on the volume indicator.
4. Holding Pipet-Plus vertically, place the tip into the sample. Press and release the trigger to aspirate the sample (C). Do not hold the plunger during aspiration; the Aspiration Rate Controller controls pickup speed.
5. Pause briefly to ensure that the full volume of sample is drawn into the tip.
6. Withdraw the tip from the sample. If any liquid remains on the outside of the tip, wipe it carefully with a lint-free tissue, taking care not to touch the tip orifice.

### Dispensing:

1. Touch the tip end against the side wall of the receiving vessel and press the plunger to the bottom of the stroke length. This is the blowout position.

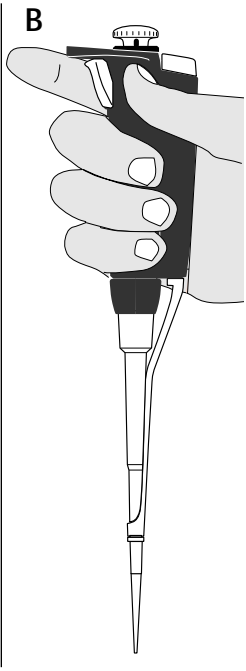
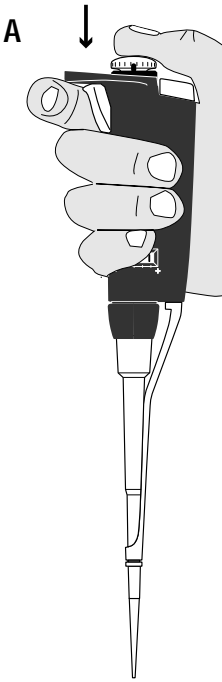
Wait: 1 second\*: 2  $\mu$ L, 10  $\mu$ L, 20  $\mu$ L, 100  $\mu$ L, 200 $\mu$ L,  
1-2 seconds\*: 1000  $\mu$ L, 2-3 seconds\*: 2000  $\mu$ L.

\* Longer for viscous solutions and 5 mL and 10 mL pipettes.

2. Still holding the plunger, withdraw the tip, sliding it along the wall of the vessel. Release the plunger.

The piston returns and latches at the zero point.

3. The piston will remain at the zero point, ready for the next pipetting cycle.
4. Press the tip ejector button lightly to discard the tip. Use a new tip for each sample to prevent carry-over. Repeat the above process for the next pipetting cycle.



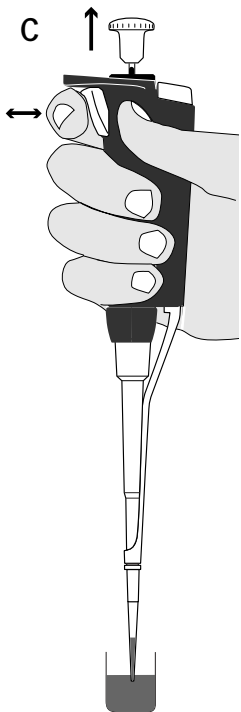
**A.** Press plunger button fully (blowout position).

**B.** Release plunger button.  
Piston returns to zero point and is latched.

**C.** Place end of tip into sample. Press and release the trigger to pick up sample.  
Aspiration Rate Controller controls piston speed during aspiration.

**D.** Dispense sample by pressing plunger button fully to blowout position (same as A).

**E.** Release plunger button.  
Piston returns to zero point and is latched.



**Figure 3** Operating Pipet-Plus

## Tip Ejector Arm Removal

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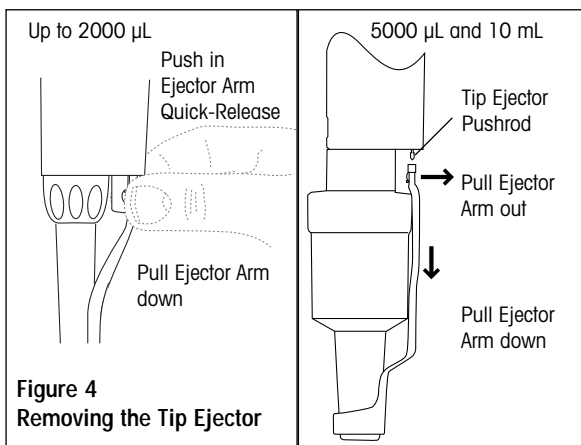
The tip ejector can be removed if necessary.

Two types of tip ejector are used and both types can be removed with minimum effort - **do not use force**. See Figure 4.

For models up to 2000  $\mu\text{L}$ , press in the quick-release tabs on the ejector arm and pull the ejector down.

For 5000  $\mu\text{L}$  and 10 mL pipettes, grasp the top of the ejector arm and pull outward then downward.

To replace the ejector arm on all models, insert the shaft through the large opening, align the top with the tip ejector pushrod, and push until the ejector arm snaps in place.



## Pipetting Guidelines

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Pipet-Plus pipettes have several features for enhanced pipetting consistency. You should also maintain:

1. Consistent pickup and dispense rhythm.
2. Consistent speed and smoothness when pipetting.
3. Consistent immersion depth. See table on page 9.
4. Pipette vertically, or no more than  $20^\circ$  from vertical.
5. Do not invert or lay Pipet-Plus down with liquid in the tip.

## Pre-Rinsing Recommended

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Some solutions (e.g. serum, protein-containing solutions, and organic solvents) can leave a film on the inside tip wall, resulting in an error larger than the tolerance specified. Since this film remains relatively constant in successive pipettings with the same tip, excellent precision may be obtained by refilling the tip and using the refilled volume as the sample. Successive samples from this same tip will exhibit good reproducibility (low variance).



## **Mixing** (recommended only above 15% of nominal volume)

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To mix two liquids in the tip, pick up sample normally. Depress and hold the trigger closed. Holding the trigger closed, place the tip end into the liquid in the well and press the plunger to dispense sample. Continue pressing the plunger until you feel the stop. Release thumb pressure and let the plunger return upward. Press and release the plunger to mix the liquids in the tip. When fully mixed, dispense the mixture.

## **Pipetting Liquids of Varying Density**

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Pipet-Plus lets you compensate for solutions of varying density by setting the volume slightly higher or lower than required. Compensation amount must be determined empirically; e.g., if pipetting 10  $\mu\text{L}$  of CsCl solution, you determine that the volume delivered is actually 8.5  $\mu\text{L}$  ( $\geq 5$  samples); set the volume to 11.8  $\mu\text{L}$  and repeat the measurements. If the volumes delivered are still not close enough to 10  $\mu\text{L}$ , make another slight volume adjustment until the measurements are as desired.

## **Temperature Considerations**

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Warm or cold liquids can be measured with good precision using a consistent pipetting rhythm, which can minimize heating or cooling effects within the pipette. Use a new tip each time for best accuracy and precision when measuring samples with temperatures greatly different from ambient, and do not pre-rinse. You will get best results if there is no delay between aspirating and dispensing the sample.

## **Tip Immersion Depth**

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The recommended depth for tip insertion into the sample for each Pipet-Plus volume is shown below.

<b>Pipet-Plus</b>	<b>Volume Range</b>	<b>Immersion Depth</b>
2 $\mu\text{L}$	0.1 - 2 $\mu\text{L}$	1-2 mm
10 $\mu\text{L}$	0.5 - 10 $\mu\text{L}$	1-2 mm
20 $\mu\text{L}$	2 - 20 $\mu\text{L}$	2 - 3 mm
100 $\mu\text{L}$	10 - 100 $\mu\text{L}$	2 - 3 mm
200 $\mu\text{L}$	20 - 200 $\mu\text{L}$	2 - 4 mm
1000 $\mu\text{L}$	100 - 1000 $\mu\text{L}$	2 - 4 mm
2000 $\mu\text{L}$	200 - 2000 $\mu\text{L}$	2 - 6 mm
5000 $\mu\text{L}$	500 - 5000 $\mu\text{L}$	6 - 10 mm
10 mL	1 mL - 10 mL	6 - 10 mm

Tip immersion depth is critical. If these depths are exceeded, the volume measured may be inaccurate, possibly out of specification. Tip angle is also important. Hold the pipette within 20 degrees of vertical.

## Pipet-Plus Storage

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Pipet-Plus is a precision instrument and should be treated with the level of care appropriate for laboratory instrumentation. After use, store it in a clean safe place. Three types of hanger are available to hold your Pipet-Plus conveniently when not in use.

**CR-7:** Free-standing carousel holds seven pipettes.

**HU-M3:** Set of three individual magnetic Hang-Ups™ for mounting on ferrous surfaces.

**HU-S3:** Three Hang-Ups attached to a clamp which fits onto a shelf.

## Troubleshooting and Repairs

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**Warning:** When removing the shaft from the body, make sure the spring, seal and o-ring do not fall off the piston, especially on the smaller models.

### Sample Splash (liquid inside the mechanism)

1. Refer to Figure 4 (p. 6) to remove the tip ejector arm.
2. On pipettes up to 1000  $\mu\text{L}$ , unscrew the shaft coupling and remove the shaft. For 2000  $\mu\text{L}$ , unscrew the shaft. For 5000  $\mu\text{L}$  and 10 mL, unscrew the lower part of the shaft.
3. Inspect the seal assembly and piston for contamination. The piston should be shiny and free of corrosion. Clean with distilled water or isopropyl alcohol. Dry with a lint-free tissue, inspect the interior of the shaft for any contamination, and reassemble.
4. If any staining and/or corrosion of the piston is evident, do not use the instrument. Call Pipette Service 800-662-7027.

### Leaks, Inaccurate Sampling, Abnormal Stroke

1. **Loose shaft.** Tighten coupling by hand.
2. **Split or cracked shaft.** Remove the tip ejector and inspect the shaft. Replace the shaft if necessary. If the shaft was dropped, remove it to see if the piston is bent. If so, return the instrument for service.
3. **Worn seal and/or o-ring.** Most models incorporate a polyethylene seal and o-ring. Examine the seal and o-ring, replacing them as necessary. Pull off the old seal and o-ring, position the new seal and o-ring on the piston assembly as shown in the line drawings on pages 10-11, and reassemble Pipet-Plus.
4. **Do not lubricate any components\*** Pipet-Plus uses a dry sealing system (\*except for the 5000 and 10 mL models which use a grease seal.)

## Acids and Corrosives

After pipetting concentrated acids or highly corrosive solutions, disassemble Pipet-Plus and inspect and clean the piston assembly, shaft, and seal with distilled water. Dry all components thoroughly and reassemble.

Extensive contact with corrosive fumes may result in premature seal wear and damage to the piston. Exposure of internal components to corrosive fumes can be reduced by using RAININ tips with aerosol barrier filters.

## Service, Calibration and Repair

**RAININ** Pipette Repair and Calibration facilities:

**California:** 7500 Edgewater Drive, Oakland CA 94621

Tel. 800-662-7027, Fax 510-564-1683

**Massachusetts:** Rainin Road, Woburn, MA 01801

Tel. 800-662-7027, Fax 781-935-7631

**Japan:** 4-1-11, Bunkyo-Ku, Tokyo 113-0033

Tel. (03) 5689-8311, Fax (03) 5689-2670

**METTLER TOLEDO** Pipette Repair and Calibration facilities:

**Belgium:** N.V. Mettler-Toledo s.a., B-1932 Zaventem

Tel. (02) 334 02 11, Fax (02) 334 03 34

**Germany:** Mettler-Toledo GmbH, D-35353 Giessen

Tel. (0641) 50 70, Fax (0641) 507 128

**Denmark:** Mettler-Toledo A/S, DK-2600 Glostrup

Tel. (43) 270 800, Fax (43) 270 828

**Spain:** Mettler-Toledo S.A.E., E-08038 Barcelona

Tel. (93) 223 76 00, Fax (93) 223 02 71

**France:** Mettler-Toledo s.a., F-78222 Viroflay

Tel. (01) 309 717 17, Fax (01) 309 716 16

**Italy:** Mettler-Toledo S.p.A., I-20026 Novate Milanese

Tel. (02) 333 321, Fax (02) 356 29 73

**Netherlands:** Mettler-Toledo B.V., NL-4004 JK Tiel

Tel. (0344) 638 363, Fax (0344) 638 390

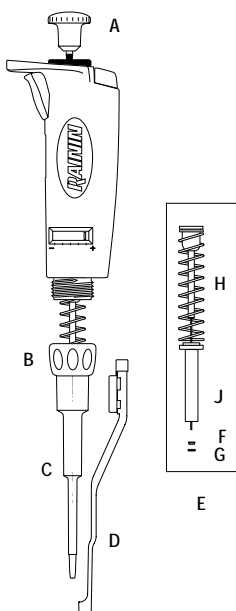
**Sweden:** Mettler-Toledo AB, S-12008 Stockholm

Tel. (08) 702 50 00, Fax (08) 642 45 62

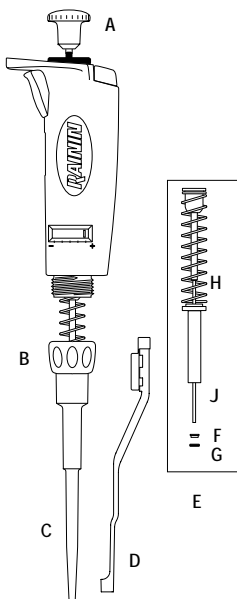
Service is also available in many other countries through authorized RAININ distributors. See [www.rainin-global.com](http://www.rainin-global.com).

Note: It is recommended to use only genuine RAININ replacement parts such as seals and shafts. It is NOT necessary to recalibrate the pipette after changing the seal or shaft. Recalibration of the pipette is only necessary when the piston is replaced, and should be done only by qualified factory-trained personnel in one of the above-mentioned facilities.

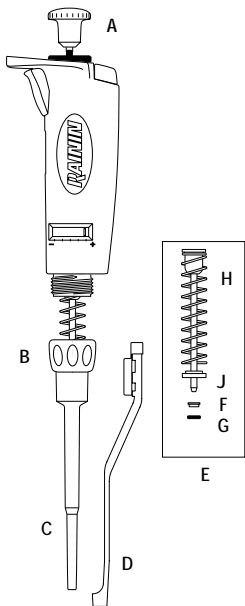
### Pipet-Plus 2 and 10 $\mu\text{L}$



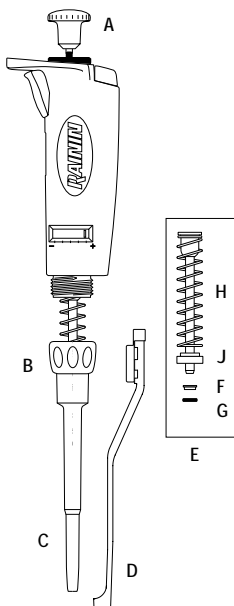
### Pipet-Plus 20 $\mu\text{L}$



### Pipet-Plus 100 $\mu\text{L}$



### Pipet-Plus 200 $\mu\text{L}$



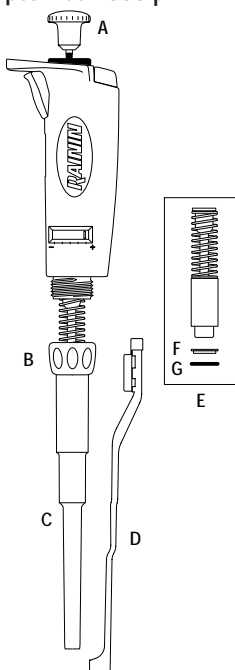
Legend for Pipet-Plus 2  $\mu\text{L}$  to 2000  $\mu\text{L}$  Models  
This page and top of next page.

A - Plunger Button  
D - Tip Ejector  
G - O-ring

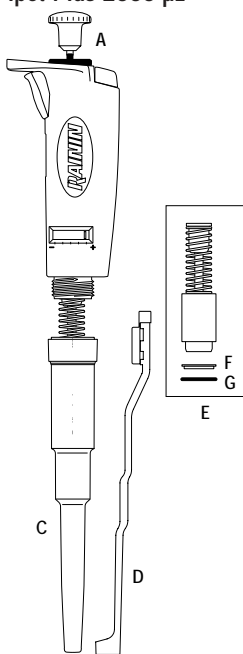
B - Shaft Coupling  
E - Piston Assembly  
H - Stroke Spring

C - Shaft  
F - Seal  
J - Seal Retainer

### Pipet-Plus 1000 $\mu\text{L}$



### Pipet-Plus 2000 $\mu\text{L}$



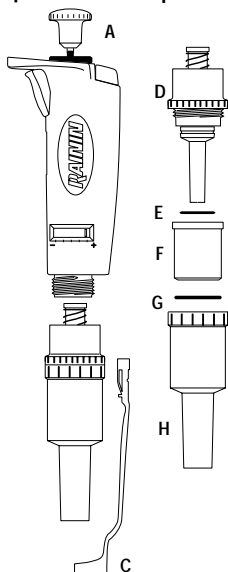
Legend for Pipet-Plus 5000  $\mu\text{L}$  and 10 mL (below)

A - Plunger Button  
E - Piston O-ring  
H - Shaft

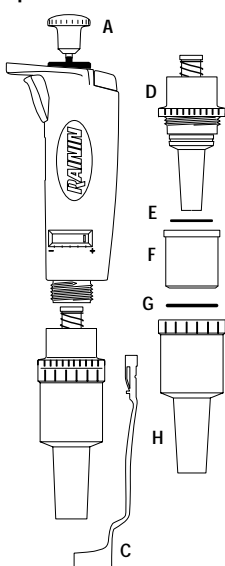
C - Tip Ejector Arm  
F - Cylinder  
G - Cylinder O-ring

D - Piston Assembly  
G - Cylinder O-ring

### Pipet-Plus 5000 $\mu\text{L}$



### Pipet-Plus 10 mL



# Replacement Parts

Legend for Pipet-Plus 2 µL to 2000 µL Models

A - Plunger Button  
D - Tip Ejector\*  
G - O-ring

B- Shaft Coupling  
E - Piston Assembly  
H - Stroke Spring

C - Shaft\*  
F - Seal  
J - Seal Retainer

R-series:

	R-2	R-10	R-20	R-100	R-200	R-1000	R-2000
A	6200-244	6200-245	6200-246	6200-247	6200-248	6200-249	6200-250
B	6200-236	6200-236	6200-236	6200-236	6200-236	6200-236	n/a.
C	6200-134	6200-140	6200-145	6200-147	6200-157	6200-160	6200-169
C <sup>†</sup> (Short Shaft)			n/a	n/a	6200-382	6200-383	n/a
D	6200-133	6200-133	6200-144	6200-148	6200-156	6200-163	6200-168
D <sup>†</sup> (Short Tip Ejector)			n/a	n/a	6202-231	6202-232	n/a
E	6200-130	6200-137	6200-142	6200-149	6200-153	6200-159	6200-165
F	6200-131	6200-138	6200-143	6200-150	6200-154	6200-161	6200-166
G	6200-132	6200-139	6200-170	6200-151	6200-155	6200-162	6200-167
H	6200-195	6200-195	6200-197	6200-197	6200-199	n/a	n/a
J	6200-196	6200-196	6200-198	6200-201	6200-200	n/a	n/a

RL-series:

	RL-2	RL-10	RL-20	RL-100	RL-200	RL-1000	RL-2000
A	6200-275	6200-276	6200-277	6200-278	6200-279	6200-280	6200-378
B	6200-236	6200-236	6200-236	6200-236	6200-236	6200-236	n/a
C	6202-063	6202-064	6202-065	6202-066	6202-067	6202-068	6202-214
C <sup>†</sup> (Short Shaft)			n/a	n/a	6202-229	6202-230	n/a
D	6202-071	6202-071	6202-071	6202-073	6202-073	6202-074	6200-168
D <sup>†</sup> (Short Tip Ejector)			n/a	n/a	6202-231	6202-232	n/a
E	6200-282	6200-283	6200-284	6200-149	6200-153	6200-159	6200-165
F	6200-131	6200-138	6200-143	6200-150	6200-154	6200-161	6200-166
G	6200-132	6200-139	6200-170	6200-151	6200-155	6200-162	6200-167
H	6200-195	6200-195	6200-197	6200-197	6200-199	n/a	n/a
J	6200-196	6200-196	6200-198	6200-201	6200-200	n/a	n/a

\* These parts are autoclavable (C - shaft, D - tip ejector arm)

† Short shaft and short tip ejector must be used together.

Legend for Pipet-Plus 5000 µL and 10 mL Models

A - Plunger Button  
E - Piston O-ring

C - Tip Ejector Arm\*  
F - Cylinder  
G - Cylinder O-ring

D - Piston Assembly  
H - Shaft\*

	R-Series:		RL-Series	
	R-5000	R-10ML	RL-5000	RL-10ML
A	6200-376	6200-377	6200-332	6200-333
C	6200-373	6200-374	6200-373	6200-374
D	6200-361	6200-367	6200-361	6200-367
E	6200-363	6200-369	6200-363	6200-369
F	6200-365	6200-371	6200-365	6200-371
G	6200-364	6200-370	6200-364	6200-370
H	6200-362	6200-368	6202-222	6202-223

\* These parts are autoclavable (C - tip ejector arm, H - shaft)

Common parts for 5000 µL and 10 mL:

Tube of grease:

6100-555

Filters:

6190-164 (pack of 100)  
6190-165 (pack of 1000)

# Specifications

These manufacturer's specifications should be used as guidelines when establishing your own performance specification in accordance with ISO 8655.

Pipet-Plus Specifications						
Model	Volume μL	Increment μL	Accuracy		Precision	
			%	μL (±)	%	μL (≤)
2 μL	0.2	0.002	12.0	0.024	6.0	0.012
	1.0		2.7	0.027	1.3	0.013
	2.0		1.5	0.030	0.7	0.014
10 μL	1.0	0.02	2.5	0.025	1.2	0.012
	5.0		1.5	0.075	0.6	0.03
	10.0		1.0	0.1	0.4	0.04
20 μL	2	0.02	7.5	0.15	2.0	0.04
	10		1.5	0.15	0.5	0.05
	20		1.0	0.2	0.3	0.06
100 μL	10	0.2	3.5	0.35	1.0	0.1
	50		0.8	0.4	0.24	0.12
	100		0.8	0.8	0.15	0.15
200 μL	20	0.2	2.5	0.5	1.0	0.2
	100		0.8	0.8	0.25	0.25
	200		0.8	1.6	0.15	0.3
1000 μL	100	2	3.0	3.0	0.6	0.6
	500		0.8	4.0	0.2	1.0
	1000		0.8	8.0	0.15	1.5
2000 μL	200	2	3.0	6.0	0.6	1.2
	1000		0.8	8.0	0.2	2.0
	2000		0.8	16.0	0.12	2.4
5000 μL	500	5	2.4	12.0	0.6	3.0
	2500		0.6	15.0	0.2	5.0
	5000		0.6	30.0	0.16	8.0
10 mL	1 mL	20	5.0	50.0	0.6	6.0
	5 mL		1.0	50.0	0.2	10.0
	10 mL		0.8	80.0	0.16	16.0

Specifications are subject to change without notice.

## Autoclaving

Autoclavable parts of Pipet-Plus are the shaft and the tip ejector: 121°C, 1 bar, 15-20 minutes.

**Do not autoclave the complete pipette or any parts other than the shaft and the tip ejector.**

### Limited Warranty

See the enclosed Limited Warranty and Limitations of Liability Statement. Please complete and return the Warranty Registration Card on receipt of your pipette.

RAININ pipettes are calibrated with RAININ tips. To assure excellent reproducibility and performance, use only RAININ tips as recommended in this manual. Specified performance is guaranteed only when RAININ tips are used.

## Contacting RAININ

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### Technical Information:

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