# CALIBRATION AND USE OF MECHANICAL PIPETTES USING THE ARTEL® PCS® 3 PIPETTE CALIBRATION SYSTEM

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## 1. SCOPE AND APPLICATION

1.1. To maintain the accuracy and precision of analytical procedures, proper pipetting techniques should be followed, and pipettes should be calibrated using a method with 3 data points or 10 data points. This calibration procedure is based on the Artel® PCS®3 Procedure Guide and applies to mechanical pipettes ranging from 0.5 to 1,000 µL.

## 2. SUMMARY OF METHOD

2.1. Pipettes are calibrated by inserting a Blank Vial into the PCS® (Pipette Calibration System) instrument and pipetting a predetermined volume of the appropriate sample solution into the vial. The PCS® instrument vortex mixes the vial and determines the volume of sample solution dispensed using a colorimetric method with a high-performance photometer. The volumes pipetted are compared to the expected volume to calculate accuracy and precision. Accuracy and precision are compared to Artel® and manufacturer specifications by the Pipette Tracker™ software. The PCS® instrument calibration should be checked every thirty days or prior to the next use, whichever is later.

2.2. Interferences:

2.2.1. Temperature change can affect pipette volumes and PCS® instrument readings. Allow pipettes to equilibrate to ambient temperature prior to pipetting. The PCS® instrument will check its own temperature before a pipette calibration run is started. If the instrument's temperature is outside the specified operational range (18ºC-28ºC), the following prompt will be displayed: "Temp. out of range; Continue? (Y/N)." Press the NO key on the instrument and wait until the instrument is within the necessary temperature range before proceeding with calibration. The Bulk Reagent Kit and Instrument Calibrator Kit should be kept in the same room as the instrument to maintain temperature equilibrium. Additionally, vials should be loaded into the vial slots on the instrument at least 15 minutes prior to their use to allow them to equilibrate to the instrument temperature.

2.2.2. Fingerprints and smudges on vials can interfere with PCS® instrument readings. Fingerprints and smudges that fall within the optical path will introduce errors and cause inaccurate readings. All PCS® vials are cleaned and inspected prior to shipment, however, the lower portion of the vials should be cleaned with a lint free wipe, such as a Kim Wipe, prior to use. If fingerprints and smudges remain, immerse the lower portion of the vial (about 2.5 cm) into clean isopropyl alcohol, holding the vial by the cap. Remove the vial from the alcohol, and while wearing gloves, gently wipe the lower portion of the vial by rotating the vial against a lint free wipe. Always wear gloves when handling vials to prevent adding fingerprints and smudges.

## 3. EQUIPMENT AND SUPPLIES

3.1. Equipment and Supplies –

| Equipment/Supply Name | Notes |
|---|---|
| PCS® (Pipette Calibration System) instrument | S/N 7-9244; Device ID #PCS-246B |
| Brother P-touch 9700PC Thermal Barcode Label Printer | S/N U62345-L3Z874852 |
| Honeywell Barcode Scanner | S/N 14164B2FA6 |
| Mechanical Pipettes for Calibration | See Table 15.1. |
| Pipette Tips of Appropriate Size for the Pipette to be Calibrated | N/A |
| Transfer Pipettes | N/A |
| Sample Aliquot Containers | N/A |
| Sample Aliquot Container Holders | N/A |

## 4. REAGENTS AND STANDARDS

4.1. Reagents and Standards –

| Reagent/Standard Kit Name | Contents | Notes |
|---|---|---|
| Bulk Reagent Kit | Blank Reagent (In prefilled Blank Vials) | Store at room temperature (18°C-28°C). Keep box closed to minimize light exposure. |
| | Range 1 Sample Solution (for volumes 200-5000 µL) | |
| | Range 2 Sample Solution (for volumes 50-199 µL) | |
| | Range 3 Sample Solution (for volumes 10-49 µL) | |
| | Range 4 Sample Solution (for volumes 2-9 µL) | |
| | Range 5 Sample Solution (for volumes .5-1.9 µL) | |
| | CAL A Calibration Standard | |
| Instrument Calibrator Kit | CAL A Instrument Calibration Standard | Store at room temperature (18°C-28°C). Keep box closed to minimize light exposure. |
| | CAL B Instrument Calibration Standard | |
| | CAL C Instrument Calibration Standard | |
| | CAL D Instrument Calibration Standard | |

## 5. PROPER PIPETTING TECHNIQUES

5.1. Adjustable and Fixed Volume Pipettes

5.1.1. For adjustable volume pipettes, check the volume setting before use. When adjusting volume, move from a higher value to a lower value. When not in use, keep the pipette at the range's highest setting. This lessens stress on the spring during storage and extends the life of the pipette.

5.1.2. Aspirate and fully expel the appropriate volume of liquid 2-3 times before aspirating for delivery to pre-wet the pipette tip. Failure to do so increases evaporation within the pipette tip air space, which can cause lower delivery volumes.

5.1.3. Hold the pipette vertically and press down the control button to the first stop on the pipette. Immerse the pipette tip into the liquid by no more than a few millimeters to prevent carryover on the outside of the tip and to reduce errors in the aspiration volume. Slowly and evenly release the control button, making sure to keep the pipette vertical. Holding the pipette at an angle when drawing in liquid will decrease accuracy. Wait 1-3 seconds (for 1-10 mL pipettes, wait 5 seconds) before pulling the pipette

tip straight up out of the liquid. If there is a drop hanging outside the tip, it can be removed by gently wiping it on the container wall.

5.1.4. Delivery volumes are temperature dependent. Make sure liquids and pipettes are stabilized at ambient temperature. Wear gloves, hold the pipette loosely, and set it down when not in use to avoid transferring body heat to the pipette.

5.1.5. Maintain consistent pressure and pipetting speed to help ensure precision.

5.2. Adjustable Volume Repeater Pipettes

5.2.1. Before inserting pipette tip, slide the filling lever all the way to the bottom and hold it there. Push the tip from below into the pipette while continuing to hold the filling lever down.

5.2.2. Select the appropriate volume by turning the volume selection wheel until it locks into the desired position.

5.2.3. Immerse the pipette tip in the liquid. Slowly and uniformly push the filling lever up to the stop.

5.2.4. Before dispensing desired volume, prime the pipette by placing the tip on the tube wall and pressing the dispensing lever once. This brings the system to the basic position.

5.2.5. To dispense, place the tip against the wall of the tube and push the dispensing lever down to the stop. The user will hear a gear movement after each discharge. If this noise is not heard after dispensing, there is not enough volume in the tip. Repeat previous steps to refill pipette tip.

5.2.6. Once complete, hold the tip in the original liquid vessel and push the filling lever to the bottom to dispense unused liquid. Hold the pipette over a waste container and press both ejection keys simultaneously to release the tip.

## 6. ADDING A NEW USER TO THE ARTEL® PCS®3 SOFTWARE™ V.1.2.2.

6.1. An administrator must log in and create a new user account. Anyone using the software or listed as a pipette owner will need to be added as a user.

6.2. Under the home button go to the Get Started section and click Add User. Enter user's **Full Name**, **Email address** and **select group** for individual.

6.3. Enter **Username** for the login (last name_first initial).

6.4. Enter user's temporary **password** (user will be prompted to change their password at login)

6.5. Optional data such as the Title, Department, and Phone Number can also be entered.

6.6. Click **Save**.

6.7. If reviewers and calibrators will be the same person, under the Lab Policy Settings for Calibration and Training, remove check box “Require reviewers to be different than operator even if operator has review permissions”.

6.8. If email notifications are not required, under the Lab Policy Settings for Notifications tab remove check box “Prompt to notify specific users when completing a device calibration or operator training”.

6.9. Under the Groups tab, an administrator can edit the group permissions including calibration-review results, change permissions for a specific user, or create a new group. Make desired changes, then click **Approve**.

## 7. ADDING A NEW PIPETTE TO THE ARTEL® PCS®3 SOFTWARE™ V.1.2.2.

7.1. Turn on computer and PCS®3 system.

7.2. Open Artel® PCS®3 Software™ V.1.2.2. and log in as an administrator.

7.3. Click **[2]** under the **Get Started** tab and add the location and description of the pipette.

7.3.1. Click **location** to add location name for pipette, the laboratory the pipette lies in.

7.3.2. Add **description** for pipette, the range of the pipette (optional).

7.4. Click **[3] (Add Pipette)** to enter new pipette information.

7.4.1. Enter manufacturer type by clicking add tab […] and scroll to find the manufacturer of the pipette in use.

7.4.2. Enter the model type by clicking add tab […], scroll and find the correct range.

7.4.3. Enter the appropriate volume ranges, the pipette I.D., location, and owner of pipette.

7.5. Click **[4] (Create Plan)** to add a pipette plan. The pipette plan will allow for imprecision and inaccuracy ranges to be designated for each pipette.

7.5.1. Enter the **Name** of pipette plan, which is the volume range for the pipette in use.

7.5.2. Enter description for pipette (optional), example: Biology, QPCR, or Micro

7.5.3. Enter the number of replicates desired for pipette.

7.5.4. Click on the tolerance tab to view the inaccuracy and imprecision sections. These will be entered to fit the standards of the pipette being added. Enter the tolerance source based on the pipette’s details. If inputting manually, use the user defined setting, if populating values automatically, use the manufacturers setting.

7.5.5. Under the Evaluation Criteria tab, if not already generated, **menu scroll**, and select Inaccuracy and Imprecision.

7.5.6. Select add tolerance in the Inaccuracy and Imprecision box and enter the Inaccuracy and Imprecision levels that are needed for the pipette in use. Select **OK**.

7.5.7. Select the **Approve** button once all targets are complete.

7.6. Click **[5] (Create Schedule)** to create a repeating calibration schedule for instruments and pipettes. Name the schedule plan by entering the pipette previously created from the pipette plans.

7.6.1. Choose the type of calibration schedule. This allows the system to notify when the next calibration due date is approaching. For pipettes select Pipette Calibration. If creating a schedule for a new instrument, select PCS® instrument.

7.6.2. Select a repeat calibration plan. Pipettes should be calibrated every three to six months per section requirements, and the PCS® instrument should be calibrated every 30 days. Add a pipette to a plan by clicking the edit button in the top left and then the **add (+) symbol** on the right side of the screen.

7.6.3. Select the Pipette I.D. from the add pipette list and attach it to the appropriate calibration plan. Example: pipette U12345, 20µL-100µL adds to the 100µL pipette plan. Once a plan has been added for the pipette click **Save**.

## 8. CALIBRATION AND DOCUMENTATION OF THE ARTEL® PCS® PIPETTE CALIBRATION SYSTEM INSTRUMENT

8.1. At a minimum, the instrument calibration should be checked every thirty days or prior to the next use, whichever is later. The instrument calibration is checked using the Instrument Calibrator Kit.

8.2. Turn on the PCS® instrument and computer. Open the Artel® PCS®3 Software™ on the computer. Upon power-on, the instrument will perform a system test. The following prompt will be displayed: “Main Menu; Pipette Calibration.” Press the **Menu Scroll** button on the instrument until “Link to Computer?” prompt appears on screen. Press the **YES** button on instrument, and “Link to Computer – Ready for Command” will be displayed.

8.3. On the software screen, the third row labeled “DUE” will display devices approaching their calibration due date. The lower row labeled “Shortcuts” will display all the devices in the system available for calibration. In both windows, pipettes are identified by their device ID (serial number) and their range (XµL-XµL). The Device ID for the instrument is “Artel PCS”

8.4. Check to see if Artel® PCS® instrument is in the work list due for calibration (>30 days). This must be completed before calibrating pipettes. If PCS® has been calibrated within 30 days, continue to pipette calibration (see Section 9).

8.5. Load the CAL A, CAL B, CAL C, and CAL D Vials from the Instrument Calibrator Kit (check expiration) into the vial slots on the instrument at least 15 minutes prior to their use.

8.6. In Artel® PCS®3 Software™, highlight and select the instrument tab in the due row.

8.7. Click on "PCS Instrument Calibration" and select the **Start Calibration** tab. The Calibration window will pop up.

8.8. Click the **Start Calibration** button.

8.9. The instrument will display a prompt to scan and then insert the CAL A Vial to take a series of readings. Use the CAL A provided in the Instrument Calibrator Kit (not the Bulk Reagent Kit). Scan the vial before inserting into instrument, as the computer prompts. Insert it into the instrument and close the door when prompted by the instrument.

8.10. When the readings are complete, the instrument will prompt to remove CAL A, followed by a prompt to scan and insert the CAL B Vial. Following the prompts, CAL B, CAL C, and CAL D are sequentially inserted. Data will not display in the program calibration window until the calibration is complete.

8.11. The "Status" section of the Calibration window will be green, and display "Passed" if the calibration passes. When an instrument calibration is successful, the date of the last instrument calibration will change to the current day. This date is displayed on the footer of subsequent pipette calibration reports. If the instrument fails its calibration, the date will not change. If the calibration fails and the "Status" section is red, clean all the CAL vials and repeat the calibration.

8.12. When calibration is complete, click the **End of Run** button.

8.13. Select the **Print Run** button at the top right corner of the screen.

8.14. When the report is displayed in print preview, select File/Export from the menu. Click the ... button on the following page and choose the correct file path to save the .pdf file. Refer to Section 10 to save the file in the appropriate folder and use the correct naming convention. The device S/N is PCS-9244 and the device ID is PCS-246B.

## 9. CALIBRATION AND DOCUMENTATION OF MECHANICAL PIPETTES

9.1. General Information

9.1.1. The pipette worklist in Artel® PCS®3 Software™ should be checked on the first of each month to determine which pipettes' calibration due dates are approaching.

9.1.2. CAL A (from the Bulk Reagent Kit) and Blank Vials should be loaded into the vial slots on the instrument at least 15 minutes prior to use. Four vials at a time can be loaded into the vial slots.

9.1.3. Before calibrating pipettes, ensure that the PCS® instrument has been calibrated within the last 30 days by checking the worklist/inventory. See Section 8 for instrument calibration procedure.

9.1.4. Each pipette is identified by its serial number which is printed on the pipette and on the barcode ID label produced by the Artel® Pipette Tracker™ program. The serial number is identical to the Device ID used in the Artel® Pipette Tracker™ program.

9.2. Pipette Calibration Setup

9.2.1. From the **Home** screen, click any **Due** pipettes, or click **Calibrate Pipette** under shortcuts to select a pipette which is not scheduled for calibration. Alternatively, the device may be selected by clicking the **Scan Pipette** under shortcuts, then scanning the barcode ID label with the barcode scanner.

9.2.2. Select the connected PCS® instrument, "Artel PCS". The PCS device ID (PCS-246B) will appear beside the selection. Connect the instrument by pressing the **Menu Scroll** button on the instrument until you see **Connect to Computer**, then press **Yes** on the instrument.

9.2.3. Click the **Start Calibration** button to begin the calibration. The instrument display will give step by step directions throughout the calibration process.

9.2.4. The instrument will perform a brief self-calibration. The following prompt will be displayed: "Self-Calibration; Please Wait," followed by "Insert CAL A Vial."

9.2.5. Remove the CAL A Calibration Standard from the vial slot on the instrument and scan it. Open the Vial Holder Cover on the instrument and insert CAL A into the Vial Holder, pressing it down until it meets the Vial Holder. Never remove the cap of the CAL A Calibration Standard. When prompted by the instrument, close the Vial Holder Cover.

9.2.5.1. Use the CAL A from the Reagent Kit in use, not the CAL A from the Instrument Calibrator Kit. The label for this vial should face toward the front of the instrument, with the vertical line on the vial facing forward.

9.2.6. The instrument will perform a Zero Check while displaying: "PCS Zero Check; Please Wait." When prompted, remove CAL A and place it into the Reagent Kit for future use.

9.2.7. The following prompt will be displayed on the instrument: "Remove Cap and Insert Blank." Remove a Blank Reagent Vial from the vial slot, scan it, remove the cap, and insert into the Vial Holder until it contacts the bottom of the Vial Holder.

9.2.7.1. Each vial contains a predetermined amount of liquid and spillage will reduce accuracy.

9.2.7.2. To ensure a consistent optical path, once the Blank Reagent Vial has been inserted into the instrument it must not be turned, moved or removed until the calibration procedure is completed for all pipettes to be calibrated using that vial.

9.2.7.3. After unscrewing the cap of the Blank Reagent Vial, hold the vial by the printed label and wipe the sides of the vial with a Kim wipe to remove any smudges or fingerprints that could have been deposited when unscrewing the cap.

9.2.8. When prompted, close the Vial Holder Cover. The instrument will read the Blank while displaying: “Reading Blank; Please Wait.” When finished, the instrument will display “Pipette Sample #1.”

9.3. Pipette Calibration

9.3.1. Locate the appropriate Sample Solution in the Reagent Kit. Scan the correct reagent Range Bottle when prompted by the instrument before you begin pipetting. The Sample Solution Range should correspond to the volume being pipetted and will be indicated by the instrument and the Calibration window in the program.

9.3.2. Using a disposable Transfer Pipette, transfer an aliquot of Sample Solution into a Sample Aliquot Container. Transfer Pipettes and Sample Aliquot Containers are found in the Plastics Kit. Place the container into the Aliquot Container Holder to reduce the possibility of spillage. Transfer only enough Sample Solution for use in half-hour increments as the solutions are light sensitive. The Calibration window will show a list of the sample volumes and number of data points needed for the pipette to be calibrated.

9.3.2.1. When handling open Blank Reagent Vials and open Sample Solutions, be careful not to spill any liquid.

9.3.3. Using proper pipetting techniques, aspirate the Sample Solution from the Sample Aliquot Container with the pipette being calibrated. Place the cap lightly back on the Sample Aliquot Container between samplings to avoid reagent evaporation.

9.3.4. Lift the Instrument Vial Holder Cover and dispense the Sample Solution into the Blank Reagent Vial.

9.3.4.1. The Sample Solution should be dispensed against the inside wall of the vial with the pipette tip placed above the meniscus but below the shoulder of the Blank Vial. The vortex mixing action will wash the solution from the inside wall of the vial.

9.3.5. Once the sample is dispensed, carefully withdraw the pipette and close the Vial Holder Cover. The instrument will display: “Mixing Sample #1; Please Wait,” followed by: “Reading Sample #1; Please Wait.”

9.3.6. After reading Sample #1, the instrument will display the results of the reading and prompt to dispense the next sample. Results will also be

displayed in the Calibration window. Follow the same procedure for each subsequent sample addition. After each subsequent sample addition, the instrument will mix, read, and display results for each sample.

9.3.7. Pay close attention to the "target value" displayed in the Calibration window when calibrating multiple volumes on an adjustable pipette. This value represents the volume to be pipetted for the given sample and will change every 3 or 10 samples depending on the calibration method being used. Make sure to check the units of the target value. It may be displayed in mL or µL.

9.3.8. Pay close attention to the Sample Solution Range displayed on the instrument and in the Calibration window when calibrating multiple volumes on an adjustable pipette. Different range solutions may be needed for different sample volumes on the same pipette. Scan each new reagent Range Bottle when prompted by the instrument before pipetting.

9.3.9. When the Blank Vial's maximum capacity is reached, the instrument will display the prompt: "Remove vial." Lift the Instrument Vial Holder Cover and remove the Blank Vial, then close the cover. Scan a new blank vial, then insert it. The instrument will calibrate with the new vial and prompt for the next sample to be pipetted.

9.3.10. After finishing a set of measurements for one sample range on an adjustable pipette, the instrument, when the next range is displayed, will display a prompt asking if you would like to replace the vial now or later. Depending on the calibration method, a prompt will appear when the blank vial has a lower capacity than is needed for three or ten samples. Select "replace later" to conserve blank vials, then replace the blank vial after the instrument displays the prompt: "Replace Vial."

9.3.11. If accuracy and precision tolerance standards are met once all samples for a given volume are dispensed, the "Status" box in the Calibration window will turn green and display: "In Tolerance." Conversely, if accuracy and/or precision tolerance standards are not met once all samples for a given volume are dispensed, the "Status" box will turn red and display: "Out of Tolerance." If the accuracy and/or precision tolerance standards are out of tolerance for a given volume, follow the corrective action procedure as described in Section 11.

9.3.12. When all samples have been dispensed, click "Finish" to complete the calibration.

9.4. Documentation

9.4.1. Once the calibration is complete, a window will pop up with a check box next to the option "Print Label." Check this box before closing the prompt. Remove the old calibration label (not the barcode ID label) and affix the new calibration label in its place. The calibration report will appear on screen. In the top right corner, hover your mouse over the icon that displays "Export Report" and select the icon. A drop-down list of file

types will appear. Select "PDF" from the list. Refer to Section 10 to save the file in the appropriate folder with the correct naming convention.

9.4.2. Click the **Close** button to close the Calibration window. If the calibration was "In Tolerance", the pipette will be removed from the worklist until it is due for the next calibration. If calibrating another pipette, follow Section 9. The instrument will not prompt for Cal A again unless a Range sample solution from another Reagent Kit must be used.

9.4.3. When calibrations are complete, remove all vials and turn off the PC, barcode label printer, and instrument. Place the cover back on the instrument. Pour contents of spent blank and reagent vials down the sink and discard empty vials in glass waste. Discard plastic caps from Blank vials and Range vials in the trash.

## 10. DATA ARCHIVAL

10.1. All calibration files should be stored in .pdf format.

10.2. For Molecular group pipettes (see the table in 15.1.), save all files in the appropriate dated folder in the following directory: \\floridadep\data\Labs\Lab3\Biology\Artel PCS\Calibration PDF files

10.3. For BenchBio group pipettes, save all files in the Artel PCS Pipette Calibration Export Files folder in the folder for the current year in the following directory: \\floridadep\data\DEAR\Labs\Lab5\Biology\BenchCommon\Calibrations\Pipette.

10.4. For all PCS instrument calibration files, save in the following folder: \\floridadep\data\Labs\Lab3\Biology\Artel PCS\PCS Instrument Calibration.

10.5. All calibration files should have the following naming convention which includes the Device ID (pipette serial number), date, and initials of the pipette calibrator.

10.5.1. Filename: DeviceID-YYMMDD-FL.pdf

10.5.2. When saving in Pipette Tracker, always make sure to add the ".pdf" extension. If it is not added, the file will not be viewable.

## 11. QUALITY CONTROL AND CORRECTIVE ACTION

11.1. If a sample point needs to be re-read due to user error, highlight appropriate sample(s) in Pipette Tracker™ and select "Redo Sample." Follow the prompts on the instrument to redo the sample point. Enter the reason for redoing the sample point in the box that appears (e.g. pipette tip fell into Blank Vial, instrument door was closed prematurely, wrong sample solution was used, etc.).

11.2. If a pipette fails to pass a pipette calibration run, save the pipette calibration report as described in Section 10 and notify a supervisor. A repeat pipette calibration run may be performed if the calibration failure was due to user error. See Section 5 for proper pipetting techniques.

11.3. All pipettes or dispensers that can no longer be used for analytical purposes or are broken should be removed from the lab. All uncalibrated pipettes that are in use in the lab must be approved for the intended use by the supervisor. They must be clearly labeled "NOT CALIBRATED" and state the approved use.

11.4. If accuracy limits fail but precision limits pass, check the difference between the average volumes measured and the volume setting for each required volume. If the difference is about the same for each weighing, then the pipette may need an adjustment. If precision fails, make sure to use proper pipetting techniques consistently. Precision cannot be adjusted on the pipette. Precision is mostly affected by handling of the pipette but can also be due to worn parts that may need replacing. For any type of failure, always check the pipette for leaks and cleanliness.

## 12. MAINTENANCE

12.1. Cleaning: Before use, always check the outside of the pipette for cleanliness. If needed, wipe the outside of the pipette with 10% bleach solution and then with deionized water to remove bleach residue. If the inside is contaminated (liquid pulled into the pipette), follow the manufacturer's instructions to disassemble the lower part of the pipette and clean with deionized water only. Remove any old grease before lubricating the piston sealing rings.

12.2. Adjustment: Determine the approximate amount of adjustment needed. Subtract the set volume from the actual volume measured for each of the volumes checked in the calibration. Use the average of these results for the adjustment. Follow manufacturer's instructions for adjustment.

## 13. SAFETY/HAZARDOUS WASTE MANAGEMENT

13.1. Refer to Material Safety Data Sheet (MSDS) for proper disposal. All PCS® Reagents are non-hazardous and aqueous based.

## 14. REFERENCES

14.1. PCS®3 Procedural Guide

14.2. Pipette Tracker User Manual QA Manual

14.3. Artel's 10 Tips to Improve your Pipetting Technique

14.4. Eppendorf Multipipette plus/Repeater plus/Xplorer plus Operating Manual

14.5. 8 Easy Steps for Performing Pipette Preventive Maintenance

## 15. TABLES

15.1. Pipettes Calibrated with the Artel® PCS®3 Software™ V.1.2.2. System

| Group | Pipette ID | Volume (µL) | Type |
|---|---|---|---|
| BenchBio | 1765876 | 10-100 | Eppendorf Reference |

| | | | |
|---|---|---|---|
| BenchBio | L40124J | 100-1000 | Eppendorf Reference |
| BenchBio | R20289F | 100 | Eppendorf Reference 2 |
| BenchBio | K45340J | 0.5-5000 | Eppendorf Research Plus |
| Molecular | P58802L | 0.5-10 | Eppendorf Research Plus |
| Molecular | P58890L | 0.5-10 | Eppendorf Research Plus |
| Molecular | P81287K | 0.5-10 | Eppendorf XplorerPlus |
| Molecular | K39700L | 0.5-10 | Eppendorf XplorerPlus |
| Molecular | L14911B | 2-20 | Eppendorf Research Plus |
| Molecular | L15097B | 2-20 | Eppendorf Research Plus |
| Molecular | I36523H | 2-20 | Eppendorf Research Plus |
| Molecular | O10026L | 10-100 | Eppendorf XplorerPlus |
| Molecular | J18706B | 10-100 | Eppendorf Research Plus |
| Molecular | J33952D | 20-200 | Eppendorf Research Plus |
| Molecular | M24765B | 20-200 | Eppendorf Research Plus |
| Molecular | M24817B | 20-200 | Eppendorf Research Plus |
| Molecular | I32865B | 100-1000 | Eppendorf Research Plus |
| Molecular | I32903B | 100-1000 | Eppendorf Research Plus |
| Molecular | I32941B | 100-1000 | Eppendorf Research Plus |
| Molecular | I32943B | 100-1000 | Eppendorf Research Plus |

## Appendix of Significant Changes

10/05/2016 Updated language for use of blank vial and added info for new pipette.

11/17/2017 Added info for new pipette.

11/15/2019 Updated information for new version of software (creating pipette plan & adding user).

11/05/2020 Cover page and table of contents added.

10/18/2021 Updated information for software prompts and calibration procedures.

09/26/2022 Added new pipettes in Table 15.1.

10/13/2023 Formatted SOP, updated file location, updated pipettes in Table 15.1.