Application Note

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digiVOL Digital Syringe | Application Note 2020

digiVOL® Quantitative Liquid Handling

Pub No. 98-35025-01

INTRODUCTION

The digiVOL is a precision laboratory device that is designed to deliver extremely accurate and precise volumes of liquids.

In this report a series of tests were carried out where required volumes were selected on the digiVOL software and gravimetric determination used to measure the actual weight and volume actually dispensed.

The results show perfect linearity of the dispensed volume and a high level of volume reproducibility. Clearly these levels of precision and accuracy cannot be achieved using conventional syringe or pipette based systems.

The digiVOL

digiVOL is a high performance handheld digital analytical syringe for aliquoting aqueous, organic and volatile liquids from 0.1µL to 10mL at pressure, with exceptional accuracy and precision.

The digVOL has a theoretical mechanical plunger displacement resolution of ±0.01mm (0.016µL for a 50µL syringe and 0.5µL for a 1.25mL syringe) enabling a liquid to be dispensed at <0.4% RSD dispensed at 5% total syringe volume.

EXPERIMENTAL

Background

To achieve high levels of accuracy and reproducibility, consideration needs to be applied to the displacement of the liquid from the needle tip into the receptor. All of this work was done by touching the needle tip to the liqud surface during the dispense. (See Publication 98-45109-01 for recommendations on how to achieve extreme precision and accuracy in dispensing liquids using the ePrep workstation).

For this work, the syringes were not pre-calibrated (reference the calibration procedure). Standard ex-factory syringe specification for the volume accuracy is +/-1% of the full syringe volume.

Method

Seven syringe sizes were used 2.4µL, 5µL, 50µL, 250µL, 500µL, 1,250µL and 5,000µL. Four volumes across the capacity range of each syringe were selected and 5 replicates dispenses were made for each volume.

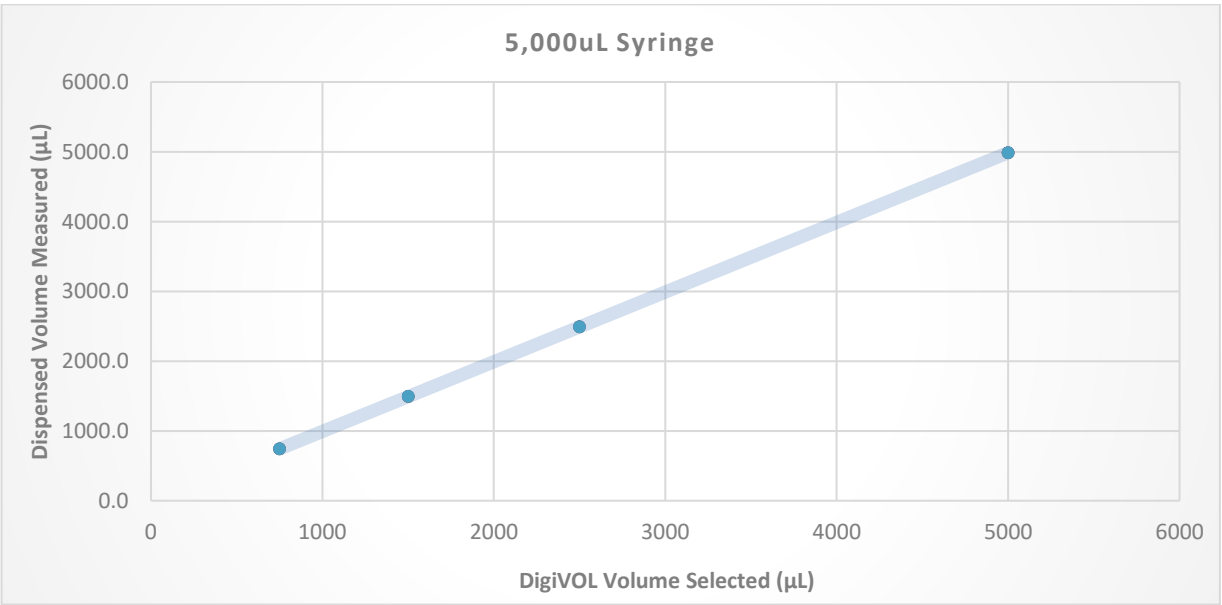
Glass vials were weighed on a five figure analytical balance (Shimadzu Model AP225WD). The syringes were filled to the selected volume and the volume fully dispensed into the vial and subsequently reweighed to determine the weight of water dispensed. The volume of the water dispensed was calculated using the specific gravity of the water, corrected for temperature.

digiVOL has the capability to select a wide range of parameters including dispense and aspirate speeds, for all this work the software default parameters for the particular syringe were used.

SUMMARY OF RESULTS

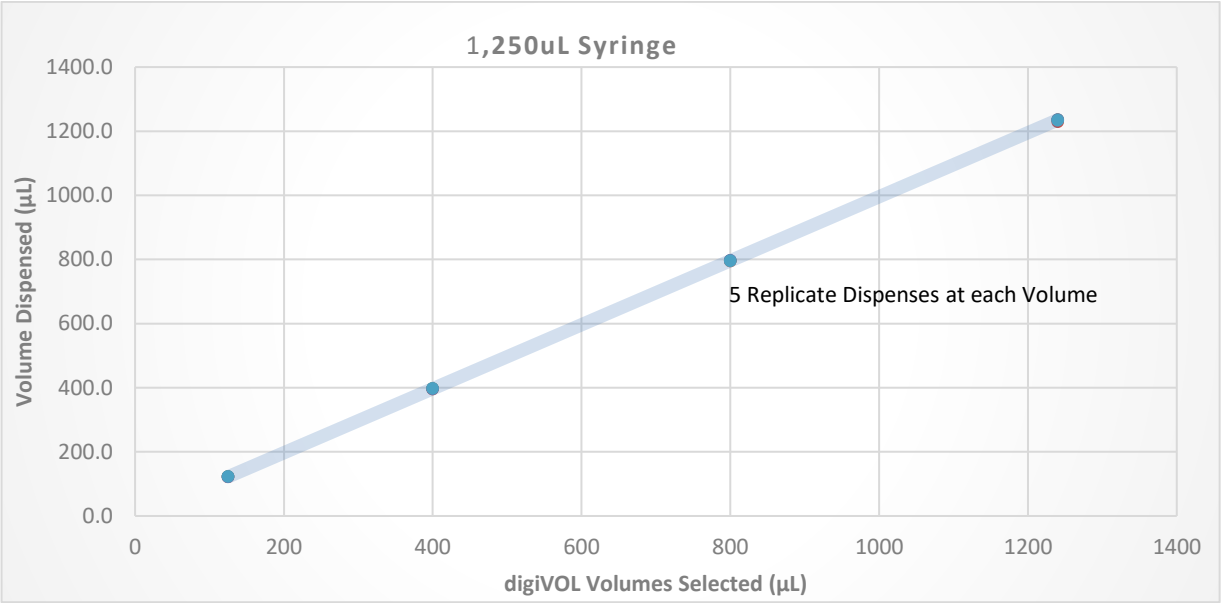
5mL Syringe – P/N 01-09026

Selected Volume	Actual Volume Dispensed	%RSD
5000	4985.44	0.01
2500	2491.26	0.01
1500	1491.90	0.02
750	742.52	0.05



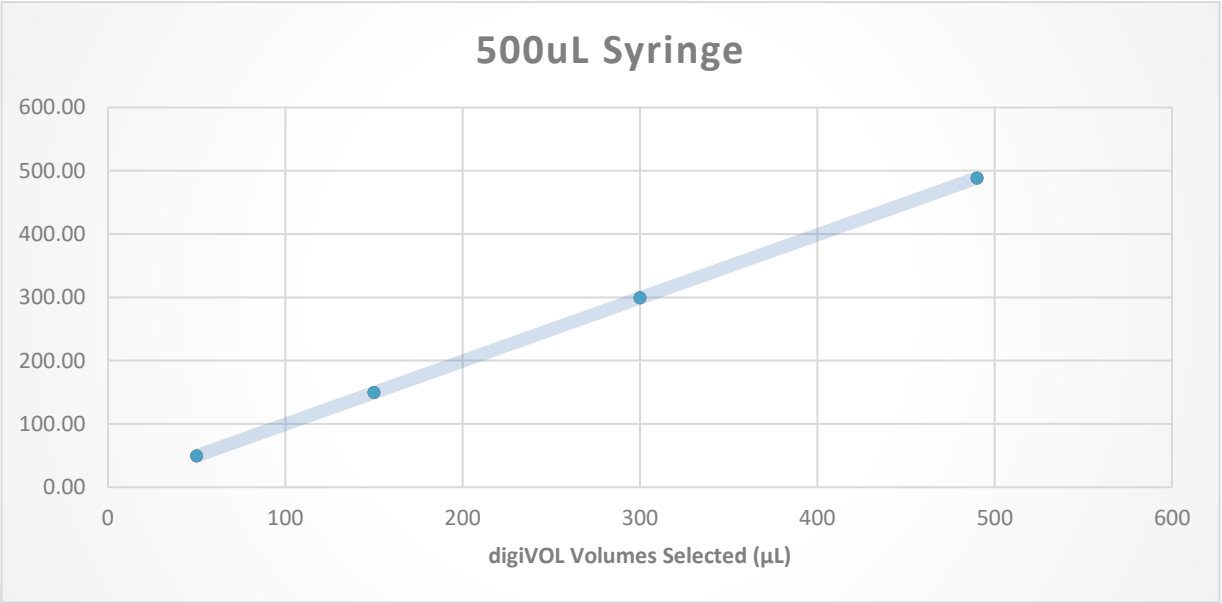
1.25mL Syringe – P/N 01-09063

Selected Volume	Actual Volume Dispensed	%RSD
1240	1233.46	0.23
800	795.62	0.06
400	396.43	0.15
125	122.31	0.50



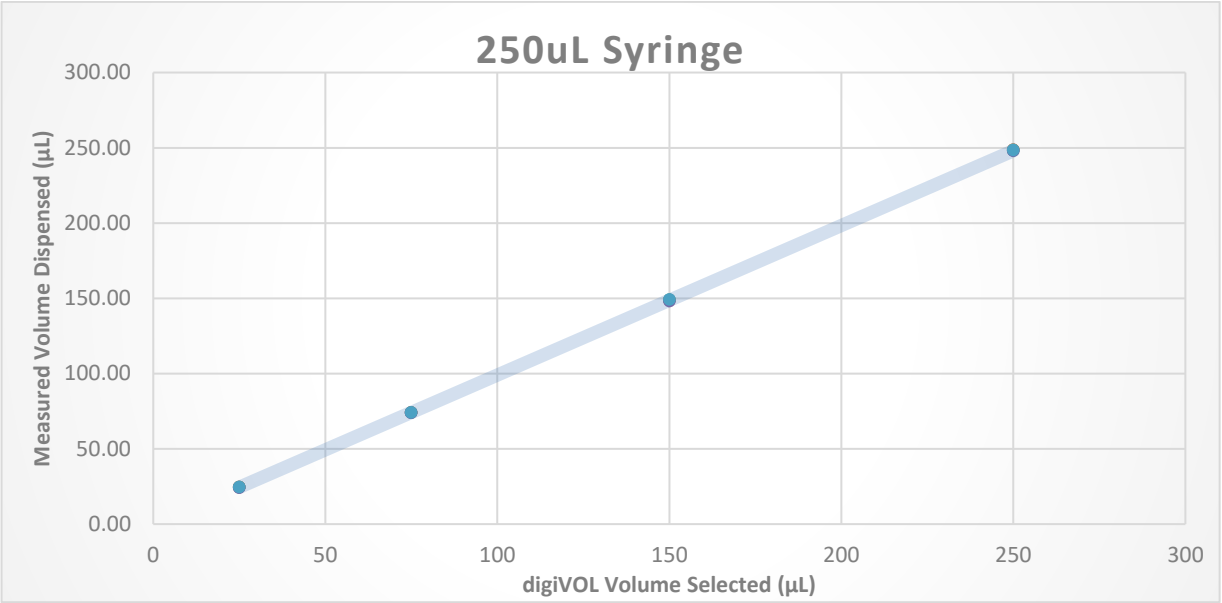
500µL Syringe – P/N 01-09062

Selected Volume	Actual Volume Dispensed	%RSD
490	488.46	0.02
300	299.26	0.07
150	149.43	0.14
50	49.47	0.36



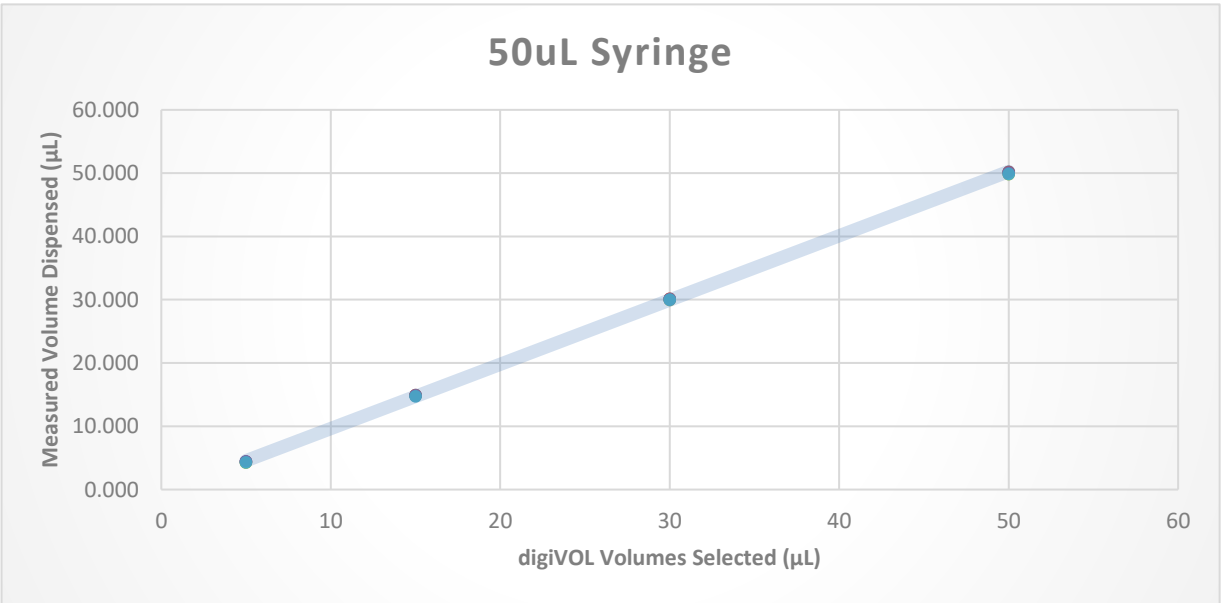
250µL Syringe – P/N 01-09061

Selected Volume	Actual Volume Dispensed	%RSD
250	248.29	0.12
150	148.69	0.29
75	74.02	0.21
25	24.36	0.66



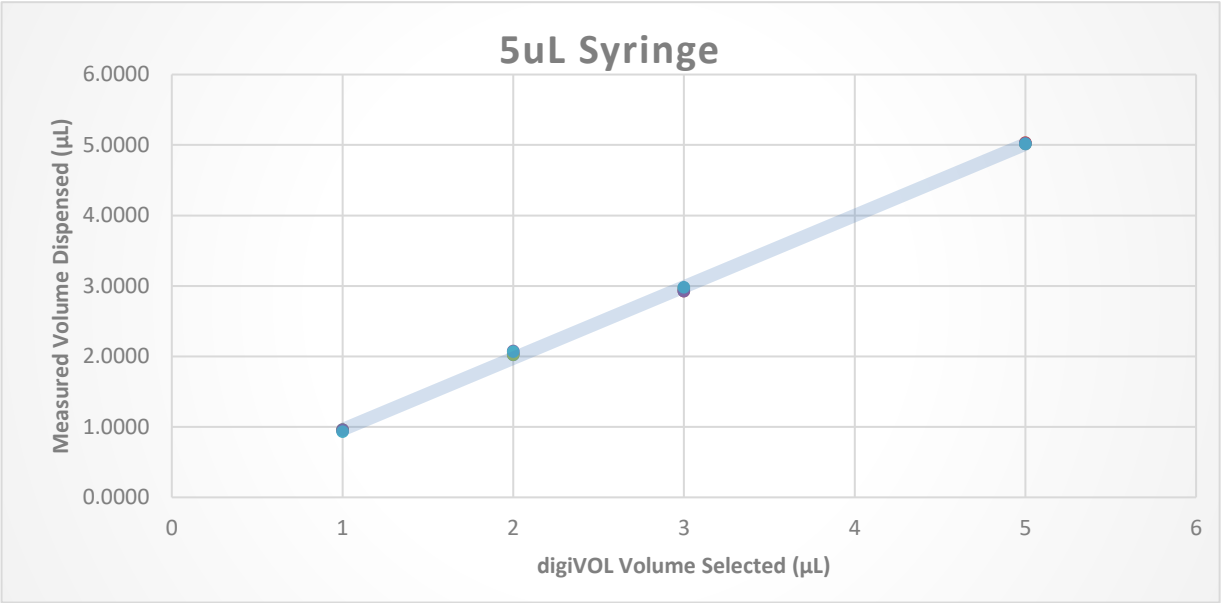
50µL Syringe – P/N 01-09058

Selected Volume	Actual Volume Dispensed	%RSD
50	50.00	0.33
30	30.03	0.29
15	14.82	0.52
5	4.34	1.65



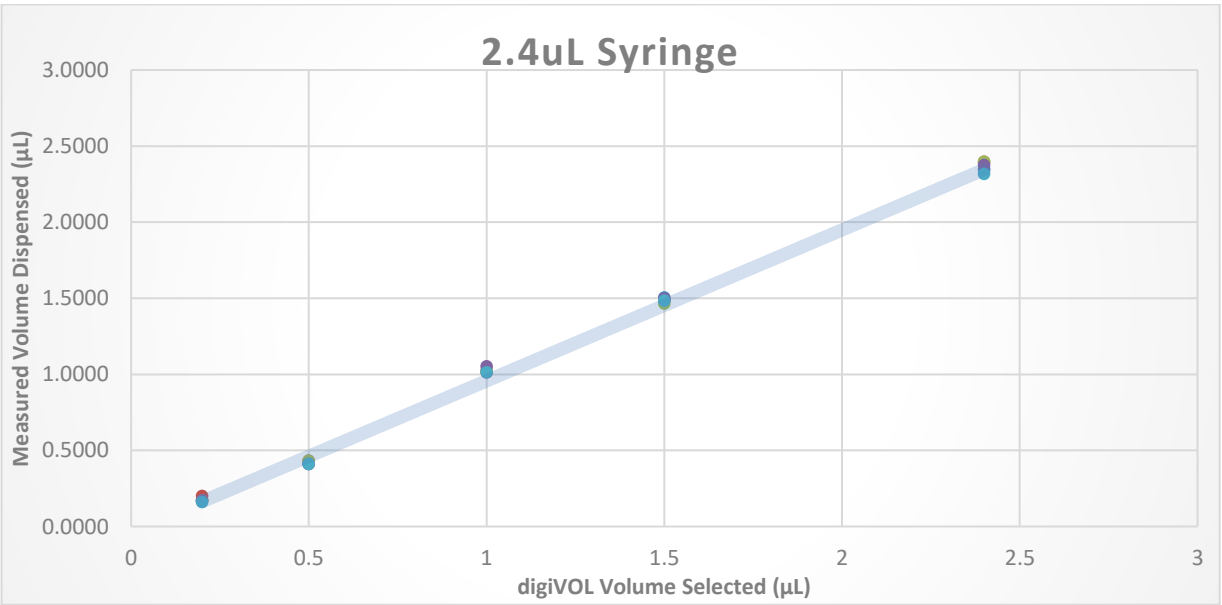
5µL Syringe – ½ scale 10uL ePrep Syringe

Selected Volume	Actual Volume Dispensed	%RSD
5	5.02	0.16
3	2.95	0.85
2	2.05	1.23
1	0.95	1.35



2.4µL Syringe – P/N 01-09054

Selected Volume	Actual Volume Dispensed	%RSD
2.4	2.35	1.47
1.5	1.48	1.15
1	1.02	1.61
0.5	0.42	2.62



CONCLUSION

Each point on the graphs is actually 5 points overlaid. The reproducibility of the dispense and measurement is such that only with the 2.4µL and 5µL syringes could differences in the points be distinguished. The reproducibility for the larger volumes was less than 0.01 – 0.5%RSD.

With the smaller 5ul and 2.4uL syringes the largest contributor to variablility was the accuracy of the gravimetric measurement of the dispensed liquid and displacement of the dispensed liquid from the syringe needle into the receiving vial.

For all the dispenses, the volume dispensed was linear and passed through the origin.

REFERENCES

1. 98-45109-01 ePrep Techniques for Precision & Accuracy, ePrep, (2019)

PRODUCT AND SPARES ORDERING INFORMATION

Part No	Description
01-08110-01	digiVOL Digital Syringe Driver Kit (X) with Flexi Stand (Bundled 01-08100-01 & 01-08150)
01-08100-01	digiVOL Digital Syringe Driver Kit (X) without Stand
Syringes	
01-09054	2.4 µL digiVOL Syringe with eZy-Connect™ Termination
01-09058	50 µL digiVOL Syringe with eZy-Connect™ Termination
01-09061	250 µL digiVOL Syringe with eZy-Connect™ Termination
01-09062	500 µL digiVOL Syringe with eZy-Connect™ Termination
01-09063	1.25 mL digiVOL Syringe with eZy-Connect™ Termination
01-09026	10 mL ePrep Syringe (usable 5 mL, ½ stroke on digiVOL)
Hub Needles for eZy-Connect Syringes	
01-10990	eZy-Connect™ Hub Needles (Pkt 10)
Accessories	
01-08150	Flexi Stand for digiVOL with Syringe Cradle