PIPETTING PERFORMANCE CAPABILITIES OF THE BIOMEK I-SERIES AUTOMATED WORKSTATION

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Introduction:

Minimizing user error and bias are important aspects for generating reliable and reproducible data while characterizing scientific problems. Automated workflows increase efficiency, and productivity, while also increasing standardization of process and data collection. Precision and accuracy during an analytical process play an important role in data generation and collection. Liquid handlers are a useful tool for automating workflow solutions, with accuracy and precision associated with the liquid transfers being a critical component of their adoption. The Beckman Coulter Life Sciences Biomek i-Series liquid handler is a versatile system and has been used to demonstrate a wide variety of applications for high-throughput testing in the fields of genomics, proteomics, drug discovery, biologics, cell line development etc. Biomek liquid handlers can transfer volumes from 0.5 μL to 1000 μL using different tip types and pipetting heads with different syringe sizes. The multichannel head is available as 384 channel with 60 μL capacity head and 96 channel, as 300 μL and 1200 μL capacity head. The Span-8 pod comes with syringe sizes of 250 μL and 1000 μL.

The Artel Multichannel Verification System (MVS®) is routinely used to verify accuracy and precision in volume transfers across liquid handlers. It is a NIST (National Institute of Standards and Technology) traceable system. The Artel company has successfully shown low-volume pipetting with calibrating techniques by adjusting offsets and slopes (1). To add on to this initiative we tested various Biomek i-Series workstations with multiple pipetting heads and Span-8 systems to be confident of the low-volume capabilities of the workstation.
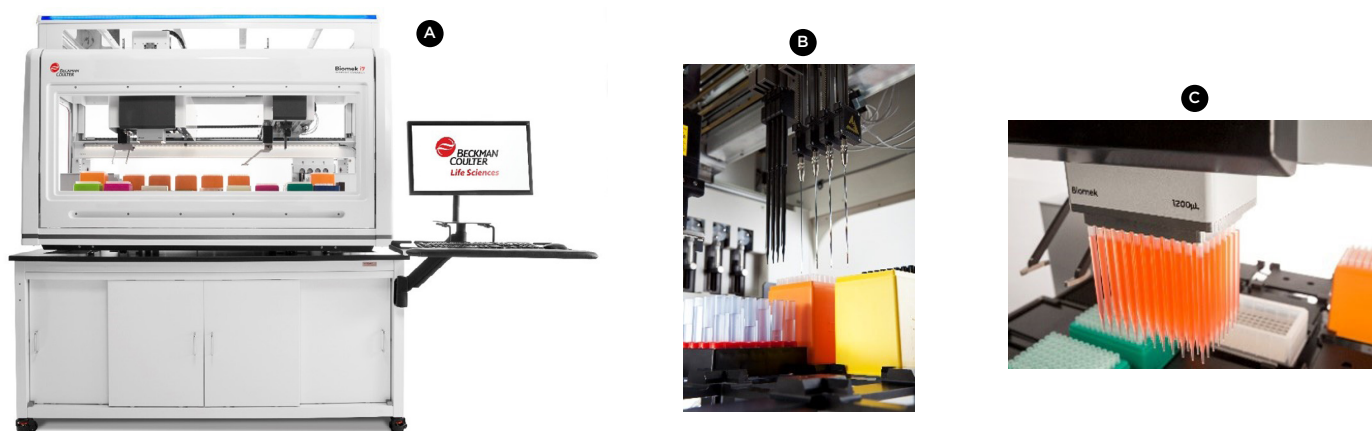
ACCELERATING *answers*

Figure 1: (A) Biomek i7 Hybrid Automated Workstation with optional enclosure on a Biomek Mobile Workstation. (B) Close up on Span-8 Pod with 4 fixed and 4 disposable tips. (C) Close up of 1200 μL MC head loaded with 96 T1070 tips.

Materials:

- Setup of devices for testing:
  - Span-8 Pod was tested on 3 of 4 different instruments.
  - For Multichannel testing, 3 of 4 different instruments were used in combination with different heads. For 96 and 384 channel heads, 4 heads in combination with different tip types were used to collect data points. For 384 capacity head, the number of tip lots tested was 2 or 3 while for 96 channel head it was 5-8.
- Biomek i-Series Automated Workstation with Biomek Software version 5.0.94
- Artel MVS Station and software version 3.2.0.14
- Biomek i-Series tips and lids

Procedure:

The volumes were measured using an Artel commercial volume measuring system using the reagents designed for it. Calibration was performed on both the measurement system and the instruments prior to commencement of actual volume testing. The development lab where testing was conducted, maintained temperature between 22.1°C and 24.8°C and relative humidity (RH) between 14.1% and 43%. For the Span-8 Pod testing, two Span-8 i5 Biomeks, an i7 dual hybrid and an i7 Span-8 system were used. Each specification listed in Table 1 was tested on 3 of the 4 instruments. A total of 288 data points were collected for each specification using three different lot numbers for the different tip types. Table 1 provides a summary of the statistics grouped by Span-8 syringe volume, volume transferred, and tip type used.

For the multichannel system two i7 Dual MC Biomeks and two i7 Hybrid Biomeks were used. A total of 4 heads were tested for each specification listed in Table 2. Different numbers of data points were collected based on the head type (more points for 384 vs 96) with each tested across three different tip lot number. Table 2 provides a summary of MC head with volume, volume transferred, and tip type used.

The target CV% was set to between 3% and 7%, and inaccuracy between 3% and 5% for the volumes tested as per the specifications[2].

Table 1:

Volume Transfer Data with Span-8 Pod

Span-8 Syringe Volume	Tip Type	Transfer Volume (µL)	Inaccuracy ±%	CV ≤%
250	Fixed	0.5	0.12	4.58
250	Fixed	1	2.42	1.71
250	T80	1	0.58	5.04
250	T90	1	0.17	4.68
250	T80	5	0.44	1.49
250	T90	5	0.15	1.41
250	Fixed	10	0.88	1.67
250	T80	10	0.43	0.92
1000	T230	10	0.34	1.26
1000	Fixed	100	0.13	1.26
1000	T1070	100	0.13	0.85
1000	T230	200	0.39	2.01
1000	T1070	900	0.10	0.39

Table 2:

Volume Transfer Data with Multichannel (MC) head

MC Head Type	Tip Type	Transfer Volume (µL)	Inaccuracy ±%	CV ≤%
384_ 60 µL	T30_384	0.5	0.38	5.06
384_ 60 µL	T30_384	1	0.05	3.71
384_ 60 µL	T30_384	5	0.08	2.96
96_300 µL	T80	1	0.48	5.5
96_300 µL	T80	5	0.76	1.58
96_300 µL	T80	10	1.03	1.38
96_300 µL	T90	1	2.77	4.61
96_300 µL	T90	5	0.09	2.45
96_300 µL	T230	25	0.31	0.85
96_300 µL	T230	200	0.17	0.63
96_1000 µL	T80	5	0.04	1.58
96_1000 µL	T80	10	0.78	2.18
96_1000 µL	T90	5	0.3	1.4
96_1000 µL	T90	10	0.64	2.06
96_1000 µL	T230	25	0.43	0.79
96_1000 µL	T230	200	0.39	083
96_1000 µL	T1070	100	0.09	0.78
96_1000 µL	T1070	950	0.1	0.28

Results:

The Span-8 pipettor of the Biomek liquid handler successfully transferred low volumes of 0.5 μL with inaccuracy of less than 0.12% and CV less than 4.58%. It transferred high volumes of 900 μL with inaccuracy of less than 0.102 % and CV less than 0.392%.

For the lowest volume transfer of 0.5 μL using the 384 MC head, the mean transfer volume for each individual head was less than 0.38% for inaccuracy and CV was less than 5.06%. The 96 MC head transferred a high volume of 950 μL with inaccuracy of 0.1% and CV less than 0.28%.

Conclusion: This application note demonstrates that using different combinations of pipetting heads and tips, the Biomek liquid handler can transfer low and high volumes with accuracy and precision, which is critical for consistency, reproducibility, and standardization of workflows.

Reference:

- Low Volume Liquid Measurement Testing with Beckman Coulter's Biomek i-Series Automated Workstation using the Artel Multichannel Verification System (MVS®). Dana Campbell

- Biomek i-Series Pipetting Performance Capabilities, 2017 AAG-2254FLY01.17

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