Omnia™ Fiducial Find: Dispensing on Variably Distanced Biosensors

Authors: Junaid Shaikh and Chris Treble



Omnia system

Purpose

Precise micro-volume dispensing is critical for maintaining assay accuracy and data integrity, especially in advanced formats such as microarrays and droplet digital PCR, which depend on exact droplet placement for multiplexing and miniaturization. However, small variations in substrate cutting, drilling, or alignment during production cause positional shifts, creating irregular biosensor layouts. Together, these factors underscore the need for dispensing solutions that deliver uncompromising precision and reproducibility to ensure reliable diagnostics and scalable research workflows.

Challenge

Develop a robust methodology for dispensing 1 µL droplets with high precision and reproducibility onto biosensors arranged in irregular positions. The approach must mitigate reagent drying and cross-contamination risks. A model system using short glass rods leaning upright in a 96-well plate will serve as an analog for uneven biosensor placement.

Solution

The solution utilizes the fiducial dispense mode of the Omnia system. This uses BioDot's™ Vision System to locate the center of each biosensor and guides dispense pattern. High humidity conditions and optimized dispense parameters ensure no cross contamination or drying of solution.

Materials

- Tray of 96 glass rods (Analog of Biosensors)
- Coating reagent (15% sucrose solution)
- PBST
- DI Water
- Ethanol
- Calibrated calipers
- BioJet™ ceramic tip (100 µm orifice)
- Omnia system



Junaid Shaikh
Applications Specialist
Junaid Shaikh is an Applications Specialist with three years of hands-on experience supporting, maintaining, and optimizing laboratory automation platforms. He has worked across several reference laboratories, giving him a practical understanding of diverse operational workflows and compliance standards. Junaid is known for his strong troubleshooting skills and collaborative approach. He excels in cross-functional teamwork and user training. His focus lies in helping laboratories achieve peak performance by improving workflow efficiency and maximizing system uptime.

© 2025, BioDot, Inc. All rights reserved

Methods Explored

Standard Setup:

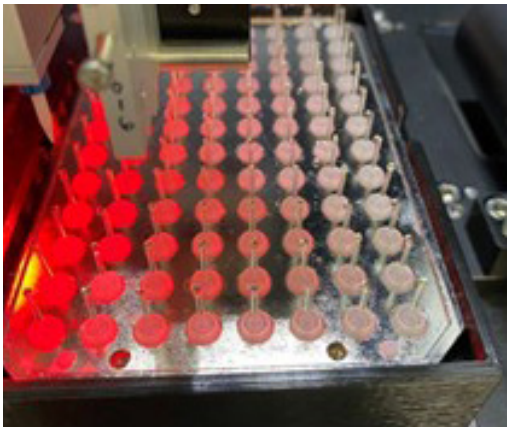
- BioJet system fluid pathway is cleaned by flushing with Ethanol then DI water.
- Prime fluid pathway with DI Water as backing solution.
- Standard wash tank and vacuum drying tip cleaning process is performed between dispense runs.
- Prepare 25x dilution of coating reagent in PBST.
- Maintain humidity at 80% to prevent droplet drying.
- Set up a new 12x8 array of vertical glass rods for each process run.

Hand Measure Process:

1. Measure the x, y, and z position of each glass rod tip by hand with calipers.
2. Program dispense location of all 96 from hand measurements.
3. Aspirate 180 µL of thoroughly mixed reagent from MTP source plate.
4. Dispense 1 µL droplets using programmed array.
5. Record accuracy of dispense.

Fiducial Dispense Mode Process:

1. Switch to fiducial dispense mode for accurate targeting.
2. The vision system's vertical camera determines fiducial location for all 96 glass rod tip positions.
3. Program dispense location of all 96 from fiducial findings.
4. Aspirate 180 µL of thoroughly mixed reagent from MTP source plate.
5. Dispense 1 µL droplets using programmed array.
6. Record accuracy of dispense.

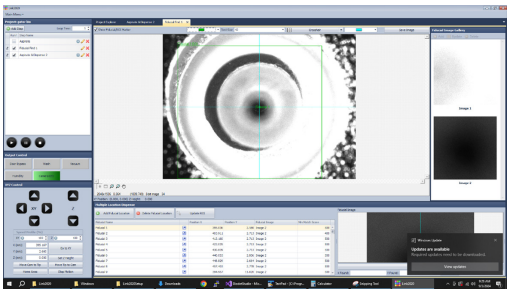


Glass Rod Biosensors

Results

Using the **Hand Measuring Process** did not yield droplets in the correct locations even after remeasuring and adjustment. As each glass rod was not in a fixed position, the pitch between each of the dispense location was variable and not uniform.

Using the **Fiducial Dispense Mode Process** available on BioDot's Omnia system, it was possible to dispense 1 µl droplets onto the glass rods surface accurately and precisely. Dispensing in the high humidity environment of the Omnia kept droplets wet and on the surface of each glass rod.



Conclusions

Accurate and precise dispensing of 1 µL droplets onto glass rods was achieved using BioDot's Vision System technology available on the Omnia system. High humidity conditions maintained droplet integrity, supporting sensitive coating applications. Fiducial mode significantly enhanced targeting accuracy. The Omnia system is highly suitable for reagent deposition onto an array of non-uniformly spaced biosensors, without the risk of cross-contamination or drying out of the reagent.

© 2025, BioDot, Inc. All rights reserved